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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

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MEMORANDUM

SUBJECT: Preliminary Ecological Risk Assessment for Registration Review of Aldicarb

FROM: N.E. Federoff, Wildlife Biologist
Edmund Wong, Environmental Chemist
Environmental Risk Branch 2
Environmental Fate and Effects Division (7507P)

REVIEWED BY: Greg Orrick, Environmental Scientist
Christina Wendel, Biologist
Environmental Risk Branch 2
Environmental Fate and Effects Division (7507P)

THROUGH: Brian Anderson, Chief
Environmental Risk Branch 2
Environmental Fate and Effects Division (7507P)

TO: Susan Bartow, Chemical Review Manager
Kevin Costello, Acting Branch Chief
Risk Management and Implementation Branch 4
Pesticide Re-Evaluation Division (7508P)

The Environmental Fate and Effects Division (EFED) has completed the Preliminary Risk Assessment (attached) conducted as part of the registration review of aldicarb. The problem formulation for aldicarb was conducted in 2012. Based on currently registered uses and labeled rates, this preliminary assessment identifies potential risks to aquatic and terrestrial non-target organisms, particularly birds and mammals. This assessment draws on information from both open literature and studies submitted by the registrants in response to data requirements in order to provide an overview of the environmental fate and ecological effects associated with the use of aldicarb as well as outlines uncertainties regarding residues and taxa of concern. Also, aldicarb has been the subject of recent refined risk assessments, which remain valid. Therefore, this assessment takes from previous assessments where possible and did not re-assess risks to all taxonomic groups. Also, this assessment is focused on species that are not Federally listed as threatened or endangered (referred to as "listed"). For taxa where there may be risk, specific

determinations for listed species are considered uncertain at this time. Currently labeled rates of aldicarb pose a potential for adverse effects, *i.e.*, risk, to non-target terrestrial and aquatic animals.

Label Clarification:

There are some uncertainties in this assessment due to label ambiguities. The vague application instructions on the MEYMIK 15G product label are listed in the following table. There would be less uncertainty in the exposure assessment if the label application instructions were clarified or clearly worded to eliminate confusion regarding the incorporation or depth of cover after application.

Instruction Issues	Description	Crop	Uses	Pages
"Apply granules in the seed furrow and immediately cover with soil by mechanical means"	No specification of the depth of soil needed to cover the granules or the depth of the application	Cotton, Dry Beans, Peanuts, Soybeans	At Planting (Aphids, Fleahoppers, Nematodes, Seedcorn maggot, Thrips)	7, 9, 10, 12
"Apply granules in a 4 to 6-inch band (T-Band) over open seed furrow and immediately cover with soil by mechanical means"	No specification of the depth of soil needed to cover the granules and no specification on the time of application	Cotton	Nematodes	7
"Apply in seed furrow and cover with soil"	No specification of the depth of soil needed to cover the granules and no specification on the time of application	Cotton	Aphids	7
"Side dress granules in a furrow that is 6 to 10 inches to one or both sides of plant row to a depth of 2 to 3 inches. Adjust applications to minimize root pruning"	No instruction on whether to cover the granules with a given depth of soil	Cotton	Side Dress (except California)	7
"Apply granules in a 4 to 6-inch band and immediately cover with soil by mechanical means. Plant into treated zone"	No specification of how much soil is needed to cover the granules or the depth of the application	Dry Beans, Peanuts, Soybeans, Sugar Beets	At Planting / Split Application	9, 10, 12, 13
"Where furrow irrigation is used, apply granules 3 to 4 inches deep and 3 inches from seed row on the water furrow side"	The depth of soil or irrigation needed to incorporate the granules is not provided.	Dry Beans	At Planting	9
"Apply granules in a 2 to 3 inch band over seed row and immediately cover with soil by mechanical means"	No specification of the depth of soil needed to cover the granules or the depth of the application	Sugar Beets	At Planting (Sugar beet root maggot)	13
"Where furrow irrigation is employed side-dress granules 4	Instructions indicated no soil cover and thus expose	Sugar Beets	Post Emergence	14

to 8 inches to water furrow side of plant row at furrow depth. Irrigate soon after application. Apply within 60 days after planting"	granules to terrestrial animals or surface runoff after irrigation or precipitation event			

United States Environmental Protection Agency

OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION

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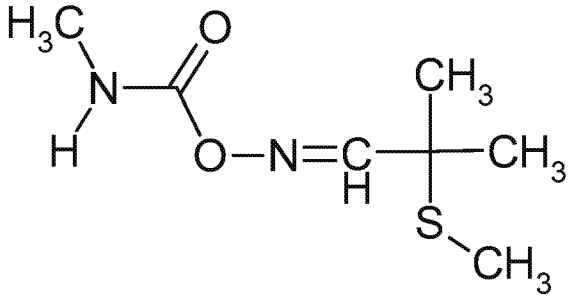
Preliminary Ecological Risk Assessment in Support of the Registration Review of Aldicarb



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Prepared by:
N.E. Federoff, Wildlife Biologist
Edmund Wong, Environmental Chemist

Reviewed by:
Greg Orrick, Environmental Scientist
Christina Wendel, Biologist
Brian Anderson, Branch Chief

U. S. Environmental Protection Agency
Office of Pesticide Programs
Environmental Fate and Effects Division
Environmental Risk Branch II
1200 Pennsylvania Ave., NW
Mail Code 7507P
Washington, DC 20460

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1. EXECUTIVE SUMMARY & CHARACTERIZATION of RISK CONCLUSIONS

The over-riding concern in this assessment is the high risk of mortality to birds and mammals. Aldicarb is very highly toxic to avian and mammalian species. It is a systemic pesticide and a potent cholinesterase (ChE) inhibitor. Acute and chronic RQs for aldicarb can be misleading since it can take the ingestion of only 1 granule for mortality to occur (Balcomb *et al.*, 1984). Supplemental open literature suggests acute oral LD_{50}s of 0.75 mg/kg for passerine species (see Section 3). The mammalian LD_{50} is similar to birds at 0.9 mg/kg. Exposure to aldicarb caused lower survivability and pup weights in offspring of all litters in testing (reproductive LOAEL = 1.4 - 1.7 mg/kg-bw; NOAEL = 0.7 - 0.9 mg/kg-bw). These toxicity values suggest that even if mammals survive acute aldicarb exposure they may suffer adverse reproductive effects from chronic exposure. In addition, since there are risks to birds, risks to reptiles are also possible.

Aldicarb is soluble in water, poorly sorbed on soil particles and could expose birds and mammals to dissolved granules after application in drinking water puddles after a rain or an irrigation event occurs. If that occurs, wildlife species are likely to be killed from drinking contaminated water from treated fields after rain. Soil incorporation does not materially reduce exposure from drinking water. Drinking water exposure alone was determined to be a potential acute and chronic pathway of concern for avian and mammalian species.

There have been numerous mortality incidents to birds and mammals where aldicarb was determined to be a likely cause. However, most of the reported incidents were either from the intentional or accidental misuse of aldicarb. Very few incidents that occur are reported to the EPA.

Aldicarb is considered highly toxic by acute contact to honeybees with an LD_{50} of 0.285 µg/bee. Because of its granular formulation, it is unlikely that there is a direct contact exposure scenario for honeybees. However, other soil dwelling beneficial insects and invertebrates could be exposed to aldicarb and aldicarb residues through contact with the granules. Contact with dissolved residues in puddles and/or with plants (via pollen and nectar) due to its systemic nature is possible.

Parent aldicarb and its degradates are highly mobile and are known to move to ground water in sandy acidic soils. Furthermore, these residues may move to surface water via runoff, drain discharge, and/or baseflow from groundwater. Aldicarb residues in baseflow are most likely to create concern for fish and aquatic invertebrates in low-order streams because these streams are dominated by base flow conditions (where up to 100% of stream flow consists of discharged ground water). Higher-order streams are sustained by much larger contributing land areas, so there is often a greater dilution effect. Higher incorporation efficiencies could reduce risks to aquatic organisms as a result of reduced runoff. However, although data are limited, there is no discerning trend of lower aldicarb and residues of concern concentrations from surface water monitoring data since the implementation of mitigation in 2009. Surface water exposure from runoff was modeled in this assessment rather than from baseflow because runoff is expected to produce higher concentrations in most surface water bodies. Under the current label scenarios modeled for EECs, most aquatic organism acute and all chronic RQs exceeded all LOCs for all registered labeled uses of aldicarb. Since there were risks to fish, there may also be risks to amphibians.

Uncertainties/Data Gaps

Honeybee toxicity (non-guideline):
In keeping with the Agency's proposed new paradigm for determining potential adverse effects to insect pollinators from conventional pesticides (USEPA *et al.*, 2014), additional studies are being requested in addition to the already submitted adult acute contact study. Although the adult acute contact study using aldicarb resulted in an LD_{50} of 0.285 µg/bee and the compound was classified as highly toxic (MRID 00036935), there is considerable uncertainty regarding the potential effects of the compound on honeybee larval development and survival as well as potential for chronic effects. Because of its granular formulation, it is unlikely that there is a direct contact exposure scenario for honeybees. Other soil dwelling beneficial insects and invertebrates could be exposed to aldicarb and aldicarb residues through contact with the granules and/or with plants (via pollen and/or nectar) due to its systemic nature. However, because the chemical is systemic in nature exposure via pollen and/or nectar is possible; therefore, additional data on pollinators is needed to fully characterize the risk associated with aldicarb use to all developmental stages of honeybees, as sensitivity may vary according to life-stage and length of exposure (adult vs. larval and acute vs. chronic, respectively). Additional information is needed, but uncertainty associated with risks to honey bees needs to be evaluated with more data for different life stages. Since this is a systemic chemical that is transported throughout the plant, residues may be available to pollinators via pollen and/or nectar; therefore, residues of pollen and nectar of crops are a data need. Adult and larvae acute oral toxicity studies (following OECD 213) and larval and adult chronic toxicity studies (following OECD 237 and non-guideline study) are necessary to evaluate the potential for aldicarb to adversely affect bees and other pollinators through other routes of exposure. Open literature data is needed to help better characterize some uncertainties regarding potential effects to bees and other non-target terrestrial invertebrates. In addition, higher tier toxicity tests (*i.e.,* semi-field and/or field studies – Tier II and Tier III, respectively) may be needed, based on the results of the larval and chronic adult toxicity studies. Higher tier studies are recommended if the ratio of the EEC and larval or adult bee acute $LD_{50}>0.4$ *or* the ratio of the EEC and the chronic NOAEC>1. Incident data and/or compelling open literature studies can also be used to support the need for higher tier studies. Should the screening level risk assessment identify that there are risk concerns to bees, mitigation measures may need to be considered or the registrant may need to conduct Tier II or Tier III effects studies (*e.g.* OECD Guideline 75 and/or 850.3040 guideline studies) that reduce uncertainty by characterizing aldicarb's effects at the whole-colony level.

2. PROBLEM FORMULATION

2.1. Introduction

The purpose of this assessment is to provide an understanding of the environmental risks of the labeled uses of aldicarb. Aldicarb is a systemic insecticide, acaricide and nematicide in the carbamate group of cholinesterase inhibitors. Aldicarb has been the subject of refined risk assessments in the past, particularly risk characterization for birds and mammals. These assessments remain valid and serve as the basis for the current risk assessment as well. Also, a formal problem formulation conducted as part of Registration Review was conducted in 2012. The problem formulation presented in this document presents a summary and an update of what was presented in the 2012 problem formulation. Reference the 2012 problem formulation for additional information (Docket EPA-HQ-OPP-2012-0161).

2.2. Pesticidal Mechanism of Action

Aldicarb (2-methyl-2-(methylthio)propionaldehyde O-(methylcarbamoyl)oxime) (PC code 098301) is a potent cholinesterase (ChE) inhibitor causing inhibition of erythrocyte acetylcholinesterase as well as plasma butyryl ChE by binding to the active site of the enzyme. Acetylcholinesterase is an enzyme necessary for the degradation of the neurotransmitter acetylcholine (ACh) and subsequent cessation of synaptic transmission. Inhibition of these enzymes in animals (*i.e.* terrestrial and aquatic invertebrates, fish, birds, amphibians, reptiles, mammals) results in the accumulation of ACh at cholinergic nerve endings and continual nerve stimulation leading to adverse effects including death. One uncertainty in the risk assessment, particularly for chronic effects, is that the toxic mode of action of aldicarb of AChE inhibition is a reversible process when exposure stops. Therefore, repeated, intermittent exposures may allow for some recovery.

2.3. Overview of Pesticide Use and Usage

Aldicarb is a granular pesticide that was first registered for use on cotton in 1970. There is currently only one end use product label for aldicarb, Meymik 15G (Reg. No. 87895-1) which was registered in December, 2011. There are 6 crops listed for use of aldicarb on the Meymik label: cotton, dry beans, peanuts, soybeans, sugar beets, and sweet potatoes. **Table 1.1** lists the use pattern of maximum exposure for each labeled uses of aldicarb.

Table 1.1 Labeled Aldicarb Use Pattern of Maximum Exposure

Use	Max. Single App. Rate (lbs a.i./A)	Max. Annual App. Rate (lbs a.i./A)	App. Interval (d)	App. Method	Labeled Use States
Cotton [C]	1.05 (At Planting) 0.75 (Side Dress) 2.1 (Side Dress)*	1.8 [A] 3.15* [A]	21	at-plant: in furrow and T-band post-emergent: in furrow	U.S. *[CA only]
Dry Beans	2.1	2.1 [A]	0	at-plant: in furrow	CO, ID, MI, OR, WA only
Peanuts [B]	1.05 (At Planting) 1.5 (Post-Emergence)	2.55 [A]	14	at-plant: in furrow, incorporated band or T-band post-emergent: banded over foliage	U.S. [Split application only in AL, FL, GA, NC, OK, TX, VA]
Soybeans	1.05	1.05 [A]	0	at-plant: in furrow or T-band	GA, NC, SC, VA only
Sugar Beets [D]	4.95 (At Planting) 3.0 (Post-Emergence) 4.05 (Post-Emergence) 2.1 (At Planting)* 2.1 (Side Dress)*	4.95 [A] 4.2* [A]	14	at-plant: in furrow, incorporated band or T-band post-emergent: in furrow, incorporated side band or side dress	[CO, ID, MT, NE, OR, WA, WY only] *[CA only]
Sweet Potatoes [E]	3.0	3.0 [A]	0	pre-plant or at-plant: band covered by hilling	LA, MS only

[A] Label directions provide a seasonal application rate limit that approximates an annual limit.
[B] Post-emergent applications must be irrigated immediately after application. Post-emergent applications must be made to dry foliage.

[C] Second application is restricted to 0.75 lb and must be placed in furrow at least 2 inches deep. Applications must be between March 1 and September 1 in California.
[D] Applications must be made within 60 days of planting.
[E] Application must be made with positive displacement applicators.

Aldicarb cannot be applied in Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, or Wisconsin. In addition, it is restricted from use in Del Norte and Humboldt Counties in California and Curry County, Oregon. Aldicarb can only be applied between March 1 and September 1 in California. There are also restrictions on the use of aldicarb around drinking water wells. In all cases, application cannot be made within 50 ft of a drinking water well, but more stringent conditions often apply. In most cases, these restrictions are based on the presence of a 'vulnerable soil' and the nature of the well. A vulnerable soil is defined on the label as having a loamy sand or sand texture and a subsoil with less than 2% organic matter on average in the upper 12 inches. Restrictions around the well are necessary if the water table is less than 25 ft deep, unless the well is cased to less than 100 ft or to 30 feet below the top of the water table. If the user does not know that the water table is greater than 25 feet, the applicator should assume a water table less than 25 feet deep.

The following state and use restrictions depend upon the vulnerable soil and well descriptions. In Alabama, Georgia, Florida, and South Carolina, if a 'split application' is made (that is, one application at planting and a second side dress application is made after emergence), then there must be a 1100 ft buffer in place around drinking water wells. In these same states, a split application made to cotton with vulnerable soil and wells requires a 1000 ft buffer. If only a single application is made either at-plant or post-emergent then the wellhead buffer is 700 ft. For all uses in Iowa, Illinois, Indiana, Michigan, Minnesota, Montana, North Dakota, Nebraska, Ohio, South Dakota, and Wyoming, a 500 ft buffer is required around vulnerable wells in vulnerable soils. In these states, vulnerable soils are defined to include sandy loams, loamy sands and sands. In Colorado, Delaware, Kansas, Kentucky, Louisiana, Maryland, Missouri, Mississippi, North Carolina, Tennessee, Virginia, and West Virginia, a 300 ft buffer is required around vulnerable wells in vulnerable soils. For all other uses in Florida (other than peanuts and cotton) a 300 ft buffer is required around all drinking water wells. For all uses, applications cannot be made within 50 ft of any drinking water well.

The Meymik label has a number of precautionary label statements for the protection of wildlife and water resources. The statements for the protection of wildlife are:

> *"This pesticide is extremely toxic to birds and other wildlife. Birds feeding on exposed granules may be killed. Cover or immediately soil incorporate granules spilled during loading, at row ends, or elsewhere to ensure the granules are completely covered with soil.*
>
> *"This pesticide is toxic to fish and aquatic invertebrates. Run-off from treated areas may be hazardous to fish in neighboring areas. Do not apply directly to water, to areas where surface water is present or to intertidal area below the mean high water mark. Do not contaminate water when disposing equipment washwaters".*
>
> *"This product is potentially toxic to honey bees through translocated residues in pollen and nectar if application is made during bloom."*

There is also additional language regarding the Endangered Species Act:

"Under the Endangered Species Act, it is a Federal Offense to use any pesticide in a manner that results in the death of a member of an endangered species."

"This Act protects Attwater's Prairie Chicken in the Texas counties of Aransas, Austin, Brazoria, Colorado, Galveston, Goliad, Harris, Refugio, and Victoria." (Note that this statement lists specific species; however, additional listed species may be at risk in Texas).

"Prior to making applications in these counties, the user must determine that this species is not located in or immediately adjacent to the area to be treated. If the user is in doubt whether or not the above named endangered species may be affected, he should contact either the regional U.S. Fish & Wildlife Service Office (Endangered Species Specialist) or personnel of the State Fish and Game Office."

Precautionary language for the protection of groundwater is:

"Aldicarb is known to leach through soil into ground water under certain conditions. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in ground water contamination. Apply this product only as specified on this label. Read the use directions and the appended Environmental Precautions and Soil Type Restrictions Tables prior to making applications."

"This product is readily decomposed to harmless residues under most use conditions. However, a combination of permeable and acidic soil conditions, moderate to heavy irrigation and/or rainfall, use of 20 or more pounds per acre, and soil temperatures below 50° F (10° C) at application time tend to reduce degradation and promote movement of residues into ground water."

However, the label does not have a surface water advisory statement. EFED recommends surface water precautionary language in the following:

"Aldicarb may impact surface water quality due to runoff of rain water. This is especially true for poorly draining soils and soils with shallow ground water.

Aldicarb is classified as having K_d less than 15 and a $t_{1/2}$ between 8 and 30 days. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential loading of aldicarb and its degradates from runoff water and sediment. Runoff of this product will be reduced by avoiding applications when rainfall or irrigation is expected to occur within 48 hours."

Cotton. There is a special local needs registration (24c) for aldicarb use on cotton in the state of California that allows up to 2.1 lb·acre^{-1} for a second side dress application and 3.15 lb·acre^{-1} total to be applied per year. For other states, the side dress application is limited to 0.75 lb·acre^{-1} and the maximum seasonal rate is 1.8 lb·acre^{-1}. In either case, two applications can be made per season to cotton with the first application made at-plant, in-furrow with the requirement that the granules in the furrow be immediately covered with soil by mechanical means. Side dress applications are to be made 3 weeks

after planting to first bloom (24c) or first squaring (Section 3 label). Side dress applications are to be to a depth of 2 to 3 inches in a furrow 6 to 10 inches on one or both sides of the the row. The label restrictions include a note to deep-disk any spills at row ends or elsewhere to ensure the granules are covered with a layer of soil. Applications in California are restricted to between March 1 and September 1. Specific restrictions for applications to cotton around drinking water wells are discussed above.

Dry Beans. While 'dry beans' can be used to describe a large number of legumes, in most cases it refers to the mature fruit of *Phaseolus vulgaris*, the common edible bean (*e.g.,* kidney bean, red bean, black bean, navy bean, *etc.*). It does not include the use on the same crop when they are picked immature (*e.g.,* green beans, wax beans, pole beans, or snap beans). The use of aldicarb on dry beans is restricted to Colorado, Oregon, Washington, Idaho, and Michigan. Only one application can be made per year at up to 2.1 lb·acre^{-1}. Applications must be made at-plant either in the seed furrow or in a separate furrow 2 to 3 inches deep to the side of the seed furrow and covered with soil by mechanical means. The label restrictions include a note to immediately deep-disk any spills at row ends or elsewhere to ensure the granules are covered with a layer of soil.

Peanuts. Either one or two applications of aldicarb can be made to peanuts. However, two applications and applications not made at planting can only be made in Alabama, Florida, Georgia, North Carolina, Oklahoma, Texas and Virginia. At-plant applications can be made either in-furrow or in a T-band over the open seed furrow. In either case the label states to cover immediately with soil by mechanical means. At-plant applications can also be made as a 6 to 12 inch band which is mechanically incorporated from 2 to 4 inches in depth into which the peanuts are subsequently planted. Post-emergent applications are to be made at or just prior to peg initiation (when the peanuts start to enter the ground) but no later than 40 days after emergence and prior to the last cultivation. At-plant applications can be made at up to 1.05 lb·acre^{-1} while the maximum post-emergent application rate is 1.5 lb·acre^{-1}. The seasonal maximum application is 2.55 lb·acre^{-1}. A second application cannot be made to Spanish peanuts and other short-season varieties that do not have at least 90 days between pegging and harvest. The label restrictions include a note to immediately deep-disk any spills at row ends or elsewhere to ensure the granules are covered with a layer of soil.

Soybeans. Applications of aldicarb to soybeans can only be made in four states: Georgia, North Carolina, South Carolina, and Virginia. Only one application can be made per year at planting at 1.05 lb·acre^{-1} for control of Mexican bean beetle, thrips, three-cornered alfalfa hopper and nematodes. Application can be made in-furrow or as a T-band 4 to 6 inches wide across the open seed furrow. In either case, the label says that the aldicarb must be immediately covered by mechanical means. The label restrictions include a note to immediately deep-disk any spills at row ends or elsewhere to ensure the granules are covered with a layer of soil.

Sugar Beets. Applications of aldicarb to sugar beets can only be made in California, Colorado, Idaho, Montana, Nebraska, Oregon, Washington, and Wyoming. Applications in California can only be made between March 1 and September 1. The maximum annual application rate is 4.2 lb·acre^{-1} in California and 4.95 lb·acre^{-1} in all other states. No more than three applications can be made per year, one application at planting, and two post-emergent applications. The maximum single application rate at-plant is 2.1 lb·acre^{-1} in California and 4.95 lb·acre^{-1} in other states. The maximum single application rate for post-emergence applications is 2.1 lb·acre^{-1} in California and 3 lb·acre^{-1} in other states. For control of nematodes, applications can be made up to a week before planting in a band 4 to 6 inches wide which is

immediately incorporated. Planting is then done into the incorporated band. Alternatively, the granules can be drilled in a row 3 to 4 inches deep and three inches to the side of the seed row if furrow irrigation is employed for seed germination. For aphid control, granules can be placed in the seedline if the application does not exceed 1.05 lb-ai·acre^{-1}. Otherwise, the granules should be drilled 1 to 3 inches below the seedline. For sugar beet root maggot control, granules can be applied in a band 2 to 3 inches wide over the seed row and immediately incorporated, or, if furrow irrigation is employed for seed germination, granules can be drilled in a row 2 inches deep 2 inches from the seed furrow. Post-emergent applications are to be made on both sides of the plant row and immediately covered with soil or, if furrow irrigation is present, 4 to 8 inches on the water side of the plants at furrow depth. Post-emergent applications must be made within 30 days of planting in California and within 60 days of planting elsewhere.

Sweet Potatoes. Applications of aldicarb to sweet potatoes can only be made in Louisiana and Mississippi. Only one application can be made at planting. Applications are restricted to 3 lb-ai·acre^{-1}. Application are to be made in a 12 inch band over open furrow or on the soil surface and covered immediately during bed formation by mechanically hilling up to 8 to 10 inches. Transplants should be made in the center of the treated zone.

The Biological and Economic Analysis Division (BEAD) completed a review of aldicarb usage (previously registered as Temik) in December 2011 (Brassard *et al.,* 2011). This assessment did not include any data for the sweet potato use. In the period 1998 to 2010 BEAD found that the total usage of aldicarb had not changed substantially, though the use on citrus increased in the latter half of the 2000s. In the period of 2006 to 2010, the average use of aldicarb on all crops was 3.6 million pound on 3.7 million acres. In this period, the top crops were cotton (47%), oranges (23%), peanuts (13%), and potatoes (6%). Under the current label, the use on oranges, other citruses and potatoes are no longer a registered use. In 1998-2010, the top states in terms of pounds applied were Florida (28%), Georgia (22%), and Texas (12%).

2.4. Description of Regulatory Action

The Food Quality Protection Act of 1996 mandated the EPA to implement a new program for assessing the risks of pesticides, *i.e.*, registration review[1]. All pesticides distributed or sold in the United States must be registered by the Agency. The decision to register a pesticide is based on the consideration of scientific data and other factors showing that it will not cause unreasonable risks to human health, workers, or the environment when used as directed on product labeling. The registration review program is intended to ensure that, as the ability to assess risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects to human health and the environment. Changes in science, public policy, and pesticide use practices will occur over time. Through the new registration review program, the Agency periodically reevaluates pesticides to ensure that as change occurs, products in the marketplace can be used safely.

As part of the implementation of the new registration review program pursuant to Section 3(g) of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the Agency is conducting an evaluation of ecological risks to determine whether use of aldicarb meets the FIFRA standard for registration.

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1 ([HYPERLINK "http://www.epa.gov/oppsrrd1/registration_review/"])

2.5. Previous Risk Assessments

The risk assessments available in the docket which serve as the basis for this preliminary risk assessment include the following:

- May 24, 2012 EFED Registration Review Problem Formulation for Aldicarb, DP D398519 (US EPA, 2012)
- March 28, 2012 EFED Risks of Aldicarb Use to the Federally Threatened Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) and the Federally Endangered San Joaquin Kit Fox (*Vulpes macrotis mutica*), (US EPA, 2012)
- April 10, 2009 EFED Refinement to Tier 2 Drinking Water Assessment Tobacco Uses of Aldicarb and its Major Degradates Aldicarb Sulfoxide and Aldicarb Sulfone, D299881 (US EPA, 2009)
- August 26, 2008 EFED Drinking Water Exposure Assessment for Proposed Expansion of Aldicarb Use on Potatoes Into 6 Additional States (CO, MI, MN, ND, SD, WY), DP D299881 (US EPA, 2008)
- July 17, 2007 EFED Risks of Aldicarb Use to Federally Listed Endangered California Red Legged Frog (*Rana aurora draytonii*), (US EPA, 2007)
- October 23, 2006 EFED Drinking Water Exposure Assessment for Total Aldicarb Residues (Parent, Aldicarb Sulfoxide, and Aldicarb Sulfone) Based on the N-Methyl Carbamate Cumulative Risk Assessment, D333309 (US EPA 2006)
- September, 2006 EFED Aldicarb Ecological Risk Assessment (RED), (US EPA, 2006)
- April 4, 2005 EFED Tier 2 Drinking Water Assessment for Aldicarb and its Major Degradates Aldicarb Sulfoxide and Aldicarb Sulfone, D316754 (US EPA, 2005)

2.6. Ecosystems Potentially at Risk

The ecosystems at risk are often extensive in scope; therefore, it may not be possible to identify specific ecosystems during the development of a nation-wide ecological risk assessment. However, in general terms, terrestrial ecosystems potentially at risk could include the areas that are immediately adjacent to treated areas that may receive runoff during flooding. Areas adjacent to the treated areas could include cultivated fields, fencerows and hedgerows, meadows, fallow fields or grasslands, woodlands, riparian habitats and other uncultivated areas.

Aquatic ecosystems potentially at risk include water bodies adjacent to or downstream from, the treated areas and could include impounded bodies such as ponds, lakes and reservoirs, or flowing waterways such as streams or rivers.

3. ANALYSIS: ENVIRONMENTAL FATE & EFFECTS

3.1. Environmental Fate

Aldicarb rapidly degrades to aldicarb sulfoxide and aldicarb sulfone – both of which are nearly as toxic as, and are more persistent than, the parent compound. Other aldicarb degradates may form as well, but are substantially less toxic and/or produced only in small amounts (<5%) and so are not included in this

evaluation (See Appendix A). Aerobic soil metabolism is the primary dissipation route for aldicarb in unsaturated soil. Half-lives for aldicarb range from 1 to 17 days (MRIDs 00102051, 00093642, 00080820, 00093640, 00053366, 00101934, 00035365, and 00102071). There is currently insufficient data to accurately estimate the formation and dissipation rates of the sulfoxide and sulfone degradates. However, the rapid oxidation of aldicarb to these degradates and their substantially greater persistence than aldicarb, have been well documented in the published literature (*e.g.*, Bull *et al.*, 1970; Smelt *et al.*, 1979).

Laboratory studies suggest that degradation of the sum of all three aldicarb forms (*i.e.*, parent compound, sulfoxide, and sulfone) to relatively non-toxic, non-carbamate residues (oximes and nitriles) occurs slowly ($t_{1/2}$ up to 3 months) in aerobic soils, as a result of soil-catalyzed hydrolysis rather than aerobic metabolism (Lightfoot *et al.*, 1987; Bank and Tyrrell, 1984). Aldicarb is generally stable to hydrolysis, slowly hydrolyzing only at a pH of 9 (MRID 00102065). Aldicarb sulfoxide hydrolyzed more quickly ($t_{1/2}$ = 2.3 days) at pH 9 than at pH 7 or 5 (about 6% at 28 days at pH 7) (MRID 00102066). Aqueous photolysis rapidly degraded aldicarb to oxime and nitrile forms (*i.e.* with a $t_{1/2}$ of four days: MRID 42498201). However, this process will only be dominant in clear, shallow waters, and will not affect residues in the subsurface.

While there is limited information on aerobic metabolism of aldicarb in aquatic environments, a published laboratory study (Vink *et al.*, 1997) reported half-lives ranging from 70 to 173 days in surface waters in the Netherlands. Aldicarb degradates (*i.e.*, aldicarb sulfoxide and aldicarb sulfone) have been detected in ground water long after application of the parent chemical had ceased. Published studies have reported increased degradation rates under low redox conditions, perhaps due to catalysis by reduced metal species in these environments (Bromilow *et al.*, 1986). For example, Smelt *et al.* (1983) reported laboratory half-lives of aldicarb sulfone and sulfoxide ranging from 2 to 131 days in Dutch subsoils under "anaerobic conditions" (310 mV), and from 84 to 1100 days under aerobic conditions. Given this information, it is likely that aldicarb sulfoxide and aldicarb sulfone, which degrade relatively slowly in aerobic soil (MRID 44005001), can leach into ground water and continue to be detectable over long time periods.

In published field studies, dissipation half-lives for total carbamate residues in soil have ranged from approximately 0.3 to 5 months in the unsaturated zone, and 1 to 36 months in the saturated zone (Jones and Estes, 1995), in apparent contradiction to the observation of faster degradation under anaerobic (saturated) conditions reported above (Smelt *et al.,* 1983). The reasons for the extreme variability in reported transformation rates (3 hours to 36 months) for aldicarb residues under anaerobic/saturated conditions are uncertain, but may be related to temperature, pH, and the presence of soils surface catalysts (Lightfoot, *et al.*, 1987). Also, not all saturated zones are necessarily anoxic; if they are shallow, there can be sufficient interaction with the unsaturated zone such that the ground water may be sub-oxic or even atmosphere-equilibrated (oxic). Monitoring data in areas with historical aldicarb contamination confirm the high persistence of total aldicarb residues in some ground water. For example, twenty years after cessation of aldicarb use on Long Island, New York, aldicarb sulfone and sulfoxide were the most frequently detected pesticide compounds in ground water there in year 2000 (Suffolk County Dept. of Health Services, 2000).

A selection of environmental fate and transport properties of aldicarb are summarized below.

Table 3.1 General Physical/Chemical Properties and Environmental Fate Parameters of Aldicarb

Parameter	Value	Reference
Physical/Chemical Parameters		
Molecular mass	190.26 g/mol	calculated
Vapor pressure (23°C)	6.25 x 10^{-6} torr	MRID 4822504
Henry's Law constant (23°C)	3.0 x 10^{-10} atm·m^3/mol	calculated
Water solubility (pH 7, 25°C)	6,000 mg/L	MRID 4822504
Octanol-water partition coefficient (K_{OW})	11.48	MRID 4822504
Persistence in Water		
Hydrolysis half-life	pH 5: no significant degradation @ 30 d pH 7: no significant degradation @ 30 d pH 9: < 10% degradation of parent @ 30 d $T_{1/2}$ < 197 d	MRID 00102065
Aqueous photolysis half-life	4 d	MRID 42498201
Persistence in Soil		
Aerobic soil metabolism half-life [25°C]	*parent only*: NJ sandy loam: 2.3 d Houston clay: 11 d Lakeland sandy loam: 17 d Norwood silty clay: 12 d unspecified: 1 d Illinois silt: 6 d NC loamy sand: 10 d *total toxic residues:* Houston clay: 28 d Lakeland sandy loam: 47 d Norwood silty clay: 136 d unspecified: 44 d	 MRID 44005001 MRID 00093642 MRID 45602904 MRID 45739801 MRID 00093642 MRID 45602904
Mobility		
Fruendlich Adsorption Coefficients (K_f)	sandy loam: 0.186 L·kg^{-1} silt: 0.36 L·kg^{-1} clay: 0.6 L·kg^{-1} sand: 0.2 L·kg^{-1}	MRID 42498202 MRID 43560301 MRID 43560302

3.1.1. Aldicarb & Residues of Concern

Aldicarb and its degradates are highly mobile and are known to move to ground water in sandy acidic soils. In poorly permeable soils, these residues will move with runoff. Following a rain event, aldicarb may reach aquatic environments as sheet and channel flow from areas of application, since aldicarb is moderately persistent in terrestrial environments and soluble in water. It is unlikely, though, that undissolved granules will reach surface water bodies as the granules themselves are not particularly mobile and in most cases buried below the surface. The toxic degradates (aldicarb sulfoxide and aldicarb sulfone) are more prone to move vertically down through the soil profile, and potentially into ground

water, as these residues form primarily in the shallow subsurface. Ground water that contains aldicarb residues may then be discharged into surface waters as baseflow or tile drain discharge. If the receiving ground water is cool, acidic, and oxic, the sulfoxide and sulfone degradates will be very persistent and capable of long-distance subsurface transport. The environmental fate and transport properties of aldicarb degradates, aldicarb sulfoxide and aldicarb sulfone are summarized in **Table 3.1 and 3.2**.

Table 3.2. Environmental Fate Parameters of Degradates of Aldicarb

Fate Endpoint	**Aldicarb sulfoxide**	**Aldicarb sulfone**
Hydrolysis – pH 5		495 d (MRID 45592104)
Hydrolysis – pH 7	6% loss at 30 d (MRID 00102066)	63 d (MRID 45592104)
Hydrolysis – pH 9	2.3 d (MRID 00102066)	1 da @ 25°C; 32 d @ 5°C (MRID 45592104)
Hydrolysis in published literature: Lemley & Zhong, 1983 (45602901); Hansen & Spiegel, 1983 (45602902); Lemley & Zhong, 1984 (45602903)	Hydrolysis is sensitive to hydroxide concentration (base-catalyzed), with sulfone most sensitive and aldicarb least (Lemley & Zhong, 1983). Aldicarb hydrolysis rates increase at pH levels >7.5; sulfoxide and sulfone hydrolyze more readily and are affected by pH and temperature (results for 5, 15 °C) (Hansen & Spiegel, 1983). Both pH and temperature dependence seen in hydrolysis of all 3 chemicals. Rates for sulfone at 25 °C 60 d @ pH7, 6 d @ pH8 (Lemley & Zhong, 1984)	
Aqueous photolysis		123 d (12 hr light/dark) (MRID 45592105)
Aerobic soil metabolism (MRID 44005001)	Concentrations fluctuated between 9-86% of applied from 7-60 day post treatment	Concentrations fluctuated between 3-80% of applied from 7-60 day post treatment
Aerobic soil metabolism range (MRID 00101934)	Total carbamate residues (parent, sulfoxide, sulfone) 11 – 110 d in 2 soils x 3 pH x 2 moisture contents; avg 34 d; 90% upper confidence bound 48 d	
Aerobic soil metabolism	5 d (MRID 45592108)	3.33 d half-life (pH 6.7 soil) (MRID 00053370)
Aerobic soil metabolism half-life	Total carbamate residues (parent, sulfoxide, sulfone) 28, 47, 136 for 3 soils (MRIDs 00093642, 00080820, 00093640, 00053366)	
Lab studies of all 3 forms (Lightfoot *et al*, 1987; Bank & Tyrrell, 1984) [A]	Combined residues (aldicarb, sulfoxide, sulfone) degraded to oximes, nitrile with half-lives up to 3 months; soil-catalyzed hydrolysis, not aerobic metabolism was driving factor.	
Lightfoot *et al*, 1987 (MRID 45602904)	Combined (parent+degradate): 44 (unsterilized) – 10 (sterilized) d surface soil 123 (unsterilized) – 16 (sterilized) d subsurface soil	

Aerobic soil metabolism, 2002 registrant submissions (MRID 45739802)		15.2 d in IL silt (pH 7.9); 91.2 d in NC loamy sand (pH 6.2).
Aerobic soil metabolism literature (Smelt et al, 1983)	sulfone & sulfoxide half-lives in Dutch subsoils from 2-131 d under anaerobic cond., 84-1100 d under aerobic condition	
Aerobic aquatic metabolism, 2002-3 registrant submissions	5 d (total system) in pH 7.0 water / pH 6.3 sediment (MRID 45592108)	3.5 d (total system) in pH 7.0 water / pH 6.3 sediment (MRID 45592109)
Anaerobic aquatic metabolism	3.4 d (MRID 45592110)	3.5 d (MRID 45592111)
Published field studies (Jones & Estes, 1995)	Summarized results of 32 field studies for aldicarb in 24 locations. Half-life of total carbamate residues (aldicarb, sulfoxide, sulfone) in surface soil ranged from 0.3 to 3.5 months; mean 1.3 mo (40 d) & 90% upper confidence bound on mean 1.5 mo (45 d). In 2 studies, estimated subsurface half-life of 5 months.	
Fruendlich Adsorption Coefficients (K_f) (MRID 42498202, 43560301, 43560302)	*aldicarb sulfoxide* ($L \cdot kg^{-1}$): Tujunga loamy sand: 0.22 Wedowee sandy loam: 0.17 Huntington silt loam: 0.26 Huntington sandy clay loam: 0.26	*aldicarb sulfone* ($L \cdot kg^{-1}$): Tujunga loamy sand: 0.09 Wedowee sandy loam: 0.12 Huntington silt loam: 0.22 Huntington sandy clay loam: 0.22

[A] Study looks at degradation of aldicarb and total carbamates (parent, sulfoxide & sulfone) in surface soil, soil water, distilled water, saturated zone soil in sterilized/unsterilized conditions

The sulfoxide and sulfone degradates are nearly as mobile as the parent and are more persistent. For aquatic exposures the parent aldicarb may undergo some transformation to the sulfoxide and sulfone residues between the time of application to the soil and a runoff event. The transformation of aldicarb to its sulfoxide and sulfone forms is shown in **Figure 1**.

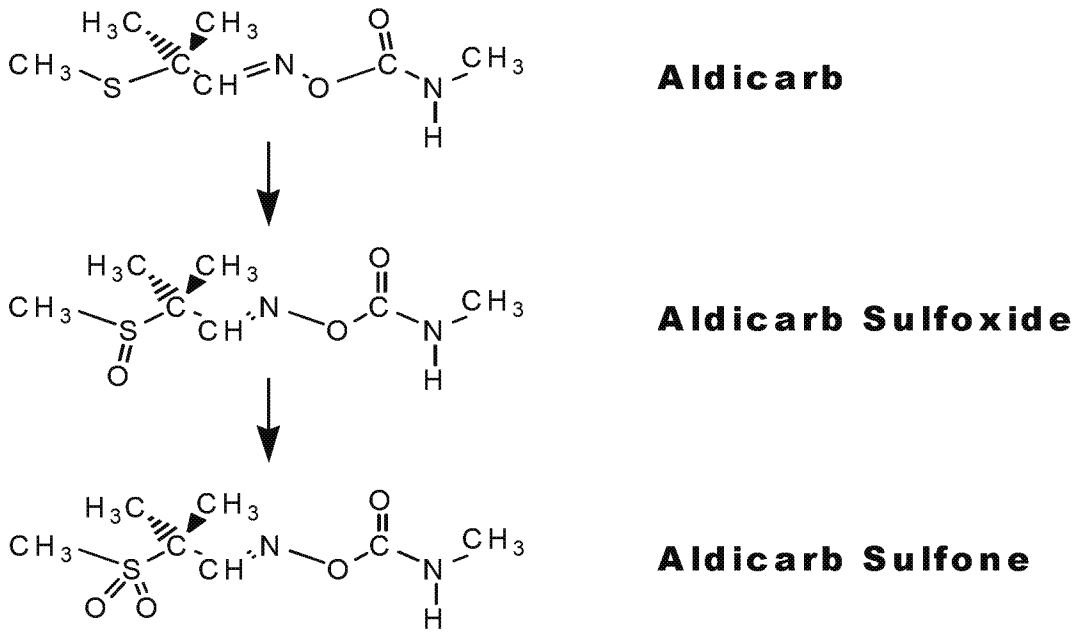

Figure 1. Chemical structure of aldicarb and its oxidative transformation products

Aldicarb and its oxidation products are all highly mobile in soil. Aldicarb itself has Freundlich K_{ads} values ranging between 0.19 ml/g (for sandy loam) and 0.60 ml/g (for clay) (MRID 42498202). Aldicarb sulfoxide has Freundlich K_{ads} values between 0.17 ml/g (sandy loam soil) and 0.26 ml/g (sandy clay loam) (MRID 43560301). Aldicarb sulfone had slightly lower values, ranging between 0.09 ml/g and 0.22 ml/g for the same set of soils as the sulfoxide (MRID 43560302). Aldicarb is not expected to be mobile into or through the atmosphere because aldicarb is applied as a granule, and because its potential to enter the air from water is considered insignificant based on its Henry's Law constant (3.0×10^{-10} atm·m^3/mol). Aldicarb may volatize from dry soil under some conditions due to its intermediate to low vapor pressure (6.25×10^{-6} torr). However, it's half-life in air is estimated by EPISuite (v4.0) to be 28 hours.

Based on the use patterns, which are all granular, minimal off-site spray drift is expected to occur for aldicarb. While aldicarb and its degradates are known to contaminate ground water, it is possible that base flow from ground water into streams may contain aldicarb residues. Aldicarb residues in water from runoff are expected to be higher and assessment of concentrations from surface runoff will be used to be protective of risks due to base flow from ground water. Because aldicarb is highly soluble and poorly sorbed on soil particles, concentrations of aldicarb in puddles that may occur after rainfall or an irrigation event may be a significant route of exposure and will be assessed for risks to terrestrial mammals and birds.

3.2. Aquatic Exposure

For the purposes of this assessment, parent aldicarb and the total toxic residues (TTR: aldicarb and its sulfoxide and sulfone degradates) were modeled separately. A TTR approach was used to assess risk to aquatic invertebrates because the sulfoxide and sulfone degradates of aldicarb are assumed to be equal in toxicity to the parent; however, parent aldicarb was used to assess risk to fish because the transformation products were shown to be 1 to 2 orders of magnitude less toxic to fish.

Exposure to aldicarb alone is estimated for fish. The soil mobility and chemical properties of aldicarb are listed in **Table 3.1**. The chemical input parameters for SWCC are listed in **Table 3.3.**

Using the Total Toxic Residues (TTR; *Ruhman, M., draft document*) method, degradation rates have been estimated for the sum of the parent and the sulfoxide and sulfone degradates. This method sums the residues of concern at each time point, and then estimates of degradation rate constant on these summed concentrations. The TTR modeling approach estimates the aquatic exposure with the aldicarb + sulfoxide + sulfone half-lives (from **Table 3.2**) and the soil mobility and chemical properties of aldicarb (from **Table 3.1**). The TTR approach is appropriate because the degradates of concern (sulfoxide and sulfone) exhibit similar environmental fate characteristics. Meanwhile, EFED recognized that the approach is conservative given the limited nature of the data.

Aquatic exposure for aldicarb alone and aldicarb TTR was estimated using the Tier II exposure model Surface Water Concentration Calculator (SWCC) (v1.21, February 19, 2015). Chemical input parameters for SWCC follow in **Table 3.3**.

Table 3.3. SWCC Chemical Input Parameters for Aldicarb and Aldicarb TTR

Input Parameter	Value	Justification	Source
K_d (mL/g)	0.16	Mean value for aldicarb TTR	MRID 42498202 43560301 43560302
	0.34	Mean value for aldicarb	
Aerobic aquatic metabolism half-life (days) [Temp. (°C)]	12 [25]	Single acceptable guideline study for aldicarb TTR (4 days) x 3	MRID 44592107
	23 [25]	No data for parent aldicarb; use 2X aerobic soil half-life	2009 Guidance
Anaerobic aquatic metabolism half-life (days)	24	No data for aldicarb TTR; use 2X aerobic aquatic half-life	Open Literature
	0	Default value in the absence of data for parent aldicarb	USEPA, 2012
Aqueous photolysis half-life (days) [Ref. Latitude (40°)]	4	Represents the single value for the residues of concern	MRID 42498201
		Single acceptable guideline study for parent aldicarb	

Input Parameter	Value	Justification	Source
Hydrolysis half-life (days) [pH 7]	0	Represents the value for aldicarb TTR and parent aldicarb	MRID 00102065
Aerobic soil metabolism half-life (days) [Temp. (25°C)]	55	Represents the upper 90% confidence bound mean for combined aldicarb TTR half-life from 19 soils	MRID 00102051 00093642 00080820 00093640 00053366 00101934 00035365 00102071
	11.6	Represents the upper 90% confidence bound mean for aldicarb half-lives from 7 soils	MRID 44005001 00093642 45602904 45739801
Foliar half-life (days)	0	Default value in the absence of data	USEPA, 2012
Efficiency	0.99	Label stated exclusively for ground use only	Meymik 15G labeled use
Drift	0	Label stated that active ingredient and formulation are in granular form, thus no spray drift	
Molecular mass (g/mol)	190.3	Molecular mass of aldicarb	Calculated
Vapor pressure (torr) [temp. (25°C)]	6.3×10^{-6}	Study value for aldicarb	MRID 00152095
Solubility in water (mg/L) (25°C)	6,000	Study value for aldicarb	Acc 255979

Chemical property and environmental fate input values were chosen in accordance with current input parameter guidance (USEPA, 2009). Based on analysis of the residues of concern (TTR) and parent aldicarb, the 90% confidence bounds on the mean half-lives for aerobic soil metabolism was selected. Meanwhile, the hydrolysis value of pH 7 and 9 were examined. Due to the fact that both pHs resulted in minor differences in output values for all crop scenarios, the environmentally relevant pH 7 was selected.

SWCC use pattern inputs are listed in **Table 3.4**. Modeled SWCC scenarios were those applicable to the labeled use sites that resulted in the highest exposure. Modeled application rates and numbers of applications per year include the maximum allowed on the label. Dates of initial application were selected within the scenario crop season and characterized by vulnerability to runoff. Runoff vulnerability was explored by modeling various application rates, application methods, and the range within the crop season including application dates, initial application dates falling on the 1st to 15th of months, an initial or follow-up post-emergence 14 to 21-day steps and selecting the date for which exposure estimates were highest. This was expected to produce high-end exposure estimates that are conservative but that may not represent the highest possible exposure. If exposure estimates resulting

from these high-end exposure scenarios do not result in risk concerns, then there are no risk concerns from less-high-end exposure scenarios either.

Aldicarb use on sweet potatoes was not modeled because the application instruction requires the granules to be covered to a sufficient soil depth (8-10 inches hilling or bed forming process) limiting runoff, thus reducing the potential surface water exposure.[2] In addition, since drift is not expected from granular application of aldicarb, offsite exposure is expected to be minimal for this use.

Table 3.4. SWCC Scenarios and Input Parameters Describing Maximum Patterns of Aldicarb Use on Representative Use Sites [A]

Use Site (Labeled Use)	SWCC Scenario	Date of App.	App. Rate in lbs a.i./A (App. Time)	App. per Year	App. Interval (days)	CAM Input	Application Efficiency/ Spray Drift
Cotton	MS cotton	Sep. 1	1.05 (At Planting) 0.75 (Side Dress)	2	21	1	0.99/0
Dry Beans	MI beans	Apr. 1	2.1 (At Planting)	1	NA	1	
Peanuts	NC peanuts	Apr. 1 Apr. 15	1.05 (At Planting) 1.5 (Post Emergence)	2	14	7 2	
Soybeans	MS soybeans	Apr. 1	1.05 (At Planting)	1	NA	1	
Sugar Beets	MN sugar beets	Apr. 16	4.05[A] (Post Emergence)	1	NA	1	

*NA = Not Applicable

[A] The 4.05 lbs a.i./A rate was selected for modeling because it is the highest application rate that can be applied over irrigation furrow without soil cover, which increases potential surface water exposure. All uses were modeled using a 2 cm incorporation depth, the default value when no depth is specified.

Surface water exposure estimates per use site for aldicarb only are listed in **Table 3.5**, while estimates for aldicarb residues of concern (TTR) are listed in **Table 3.6**. Model input and output files are attached in **Appendix B**. The maximum use pattern on sugar beets results in the highest environmental exposure concentrations (EEC).

Table 3.5. Aquatic Exposure Estimates from Aldicarb Use Sites (Aldicarb Only)[A]

Use Site	SWCC Scenario	1-in-10-year Peak (µg/L)	1-in-10-year 21-day Mean (µg/L)	1-in-10-year 60-day Mean (µg/L)
Cotton	MS cotton	28.9	25.7	19.9
Dry Beans	MI beans	28.2	26.4	21.8
Peanuts	NC peanuts	17.4	14.7	11.8
Soybeans	MS soybeans	22.3	19	13.2
Sugar Beets	MN sugar beets	**53**	**47.7**	**36.8**

[A] Maximum values are in bold.

[2] The SWCC only considers runoff in the top 4 cm for ground applications; therefore, no runoff would result from modeling this scenario.

Table 3.6. Aquatic Exposure Estimates from Aldicarb Use Sites (Aldicarb TTR)[A]

Use Site	SWCC Scenario	1-in-10-year Peak (µg/L)	1-in-10-year 21-day Mean (µg/L)	1-in-10-year 60-day Mean (µg/L)
Cotton	MS cotton	35.1	28.3	17.7
Dry Beans	MI beans	30.6	26.4	18.2
Peanuts	NC peanuts	21.1	15.6	10
Soybeans	MS soybeans	26.7	20.1	11.3
Sugar Beets	MN sugar beets	**78**	**59.7**	**38**

[A] Maximum values are in bold.

3.3. Bioaccumulation

Aldicarb and residues of concerns are not expected to appreciably bioaccumulate in aquatic or terrestrial organisms given the low log K_{OW} of 1.06.

3.4. Monitoring Data

Included in this assessment are available data on aldicarb, aldicarb sulfone, and aldicarb sulfoxide (aldicarb residues of concern) from non-targeted monitoring conducted in the following water monitoring programs: the California Department of Pesticide Regulation (CDPR) surface water database ([HYPERLINK "http://www.cdpr.ca.gov/docs/emon/surfwtr/surfcont.htm"]), the USGS NAWQA surface and ground water database ([HYPERLINK "http://cida.usgs.gov/nawqa_queries_public/"]), the USEPA STORET Data Warehouse ([HYPERLINK "http://www.epa.gov/storet/"]).

3.4.1. USEPA STORET Data Warehouse Surface Water Data

STORET data indicate that all 50 states in the U.S. including the District of Columbia were monitored for aldicarb, aldicarb sulfone, and aldicarb sulfoxide at various times from February 1986 to December 2014. Samples were collected from 793 sites, with parent aldicarb, sulfoxide, and sulfone sample totals of 2229, 2215, and 2121, respectively. Aldicarb residues were detected in 222 samples with a detection percentage of 1.8% out of the total samples. The lowest range of detection level was 0.017 µg/L and the highest detected concentration was 0.5 µg/L.

Parent aldicarb and sulfone was detected simultaneously in one sample with a concentration of 0.5 and 0.4 µg/L, respectively in San Miguel County, New Mexico on August 2001. Sulfoxide was detected in a total of five samples with the highest concentration at 0.3 µg/L in San Miguel, New Mexico on August 2001. The other four samples were found within the range of 0.0173-0.111 µg/L between May 2004 to April 2006 in Mohave, San Diego, and Alameda Counties, California (U.S. Geological Survey 2015).

Monitoring data for USEPA STORET results indicated that the monitoring is non-targeted and while some sites were sampled twice to more than ten times but the overwhelming majority were sampled only once. The timing of the monitoring was irregular as well. Some sites were monitored for several consecutive years, however, many sites with detected aldicarb and residues were only sampled once and no follow-up monitoring. Hence, the data cannot be correlated with aldicarb use.

3.4.2. USGS NAWQA Surface Water Data

NAWQA data indicate that 50 states in the U.S. and the District of Columbia except for Kentucky were monitored for aldicarb, aldicarb sulfoxide, and aldicarb sulfone at various times from May 1992 to December 2013. A total of 99 samples were collected from 34 sites. The total number of parent aldicarb, sulfoxide, and sulfone detections and percentage per total number sampled were 231 and 0.5%, respectively. Parent aldicarb, sulfoxide, and sulfone detections in surface water monitoring data are summarized in their individual sections in the following:

3.4.2.1. Aldicarb

Criteria	Data
Number of Surface Water Detections	54 (8,456 Total Samples)
Lowest Surface Water Detection	0.08 µg/L (Weld County, CO; July 1994)
Highest Surface Water Detection	**2.21** µg/L (Sumter County, GA; September 1993)
Earliest Detection	0.34 µg/L (Beaufort County, NC; April 1993)
Latest Detection	0.1625 µg/L (Washington County, MS; May 2005)

State	County	Detection Numbers	Concentration (µg/L)	Collection Date Range
AL	Russell, Houston, Henry	4	0.28 - 0.37	June 1993
CA	Merced	1	0.46	April 1993
CO	Weld	1	0.08	July 1994
GA	Baker, Carroll, etc. (21 Counties)	41	0.26 - 0.9	Jun – Nov 1993
	Cobb*	1	**1.47**	Nov 1993
	Sumter*	1	**2.21**	Sep 1993
MS	Washington	1	0.1625	May 2005
NJ	Somerset	1	0.13	Jul 1997
NC	Beaufort	1	0.34	Apr 1993
SC	Orangeburg	1	0.48	May 1996
WY	Big Horn	1	0.37	Apr 1999

*Location were listed specifically due to concentration over 1µg/L. Numbers are also bolded.

3.4.2.2. Aldicarb Sulfoxide

Criteria	Data
Number of Surface Water Detections	33 (8,334 Total Samples)
Lowest Surface Water Detection	0.0009 µg/L (Hancock County, IN; July 2010)
Highest Surface Water Detection	**1.91** µg/L (Madison, LA; May 1997)
Earliest Detection	0.92 µg/L (Sumter County, GA; April 1994)
Latest Detection	0.0024 µg/L (St. Mary County, LA; May 2011)

State	County	Detection Numbers	Concentration (µg/L)	Collection Date Range
AL	Madison	14	0.0033-0.1674	Apr 2000 – Apr 2010
CA	San Joaquin	1	0.0047	Feb 2002

CO	Weld	1	0.98	Aug 1994
GA	Sumter	1	0.92	Apr 1994
IN	Hancock	1	0.0009	Jul 2010
LA	Madison	4	0.5 – **1.91**	May 1997
	St. Mary	1	0.0024	May 2011
MS	Warren, Washington	6	0.004 - 0.1009	May 2005 – Jun 2010
OR	Marion	2	0.0042 - 0.008	Jun – Jul 2002
SC	Orangeburg	1	**1.2**	May 1996
NY	Suffolk	1	0.0183	Jul 2007

*Concentrations >1 µg/L are bolded.

3.4.2.3. Aldicarb Sulfone

Criteria	Data
Number of Surface Water Detections	12 (8,344 Total Samples)
Lowest Surface Water Detection	0.065 µg/L (Madison County, AL; October 2000)
Highest Surface Water Detection	0.1574 µg/L (Denver, CO; April 2002)
Earliest Detection	0.07 µg/L (Washoe County, NV; July 1994)
Latest Detection	0.0059 µg/L (Sarpy County, NE; August 2010)

State	County	Detection Numbers	Concentration (µg/L)	Collection Date Range
AL	Madison	8	0.065 - 0.1035	Apr 2000 – Apr 2010
CO	Denver	1	0.1574	Apr 2002
NE	Sarpy	1	0.0059	Aug 2010
NV	Washoe	1	0.07	Jul 1994
NY	Suffolk	1	0.0287	Jul 2007

3.4.2.4. USGS NAWQA Monitoring Data Summary

Monitoring data from USGS NAWQA was more extensive than that of USEPA STORET. Results shows that the detection frequencies for parent aldicarb were in the Southeastern U.S., where out of 54 samples, 43 were in Georgia. Except for 2 samples were from the same sites, all of them were from different sampling sites. The detection frequencies for both aldicarb sulfone and sulfoxide were also mostly at different sampling points in the Southeastern U.S.

USGS NAWQA database follows similar trend to that of USEPA STORET where it is non-targeted monitoring and the timing of monitoring is irregular. Further, the sample collection was not targeted for aldicarb use and the data cannot be correlated with aldicarb use as well.

3.4.3. California Department of Pesticide Regulation (CDPR) Surface Water Database

The CDPR Surface Water Database indicates that aldicarb TTR was analyzed at 293 surface water sites in California at various times from February 1991 to October 2010. A total of 6795 samples were collected. While some sites were sampled for a total of 16 times over the span of 4 years, most of the sites were sampled at least 3 or more times at various times. Aldicarb and its residues were detected in a

total of eleven samples, where eight were of parent aldicarb. The earliest detection of aldicarb was in San Joaquin River, Stanislaus in July 1991 and the most recent was in two storm drain samples in Sacramento on August 2009 with the lowest range concentration of 0.084-0.086 µg/L. Aldicarb was detected in the same sampling point twice (Miles Creek, Merced County) with the highest measured concentration of 5.4 µg/L on June 2007 but decreased 10-fold to 0.53 in June 2008. Other detections of aldicarb occurred in Colusa Basin drain, Yolo (0.7 µg/L) on April 2000, Deadman Creek, Merced (1.2 µg/L) on June 2007, and Logan Creek, Colusa (1.5 µg/L) on May 2008.

Aldicarb sulfone was detected in two samples, 0.05 µg/L on August 1991 in the San Joaquin River and 0.258 µg/L on February 1992 in Turlock Irrigation District drain, both on Stanislaus County. Meanwhile, sulfoxide was measured in one sample at 0.28 µg/L on July 1991 in the San Joaquin River.

3.4.4. Monitoring Data Summary

Aldicarb, aldicarb sulfoxide, and aldicarb sulfone were monitored in non-targeted sites for surface water in all 50 states in the U.S. including the District of Columbia from February 1986 to December 2014. Note that much of this monitoring data was collected prior to mitigation and use reduction associated with reregistration of aldicarb. The mitigation was implemented in 2009. Overall, the highest detection of aldicarb residues of concern in these databases is 5.4 µg/L in surface water (parent aldicarb). This concentration is within an order of magnitude of modeled chronic exposure estimates (10.7 µg/L for surface water) for aldicarb residues of concern.

The 2009 mitigation implementation may have caused the decrease in the number of detections and concentrations of aldicarb, aldicarb sulfoxide, and aldicarb sulfone in surface water. However, since the monitoring databases were non-targeted, especially for aldicarb use, and the sampling frequency was inconsistent, the observation cannot be verified by the lack of detections of aldicarb and its residues in surface water samples post 2009.

3.5. Ecological Effects Characterization

Consistent with current procedures, the risk assessment for aldicarb will rely on a surrogate species approach. T**[SEQ CHAPTER \h \r 1]**oxicological data generated from surrogate test species, which are intended to be representative of broad taxonomic groups, are used to extrapolate to potential effects on a variety of species (receptors) included under these taxonomic groupings.

The Agency evaluates the potential for adverse effects as a result of aldicarb usage. The most sensitive endpoint for each taxon is used for RQ calculations. Assessment endpoints include direct toxic effects on the survival, reproduction, and growth of terrestrial and aquatic life, as well as indirect effects, such as reduction in prey base and/or modification of habitat. The evaluated taxa include fish, aquatic invertebrates, birds, small mammals, terrestrial invertebrates, aquatic plants, and terrestrial plants.

Acute (short-term) and chronic (long-term) toxicity information is characterized based on registrant-submitted studies and a comprehensive review of the open literature on aldicarb. A summary of the available ecological toxicity data (including review classifications and associated deficiencies) for aldicarb and degradates is in **Appendix A**. The data is summarized briefly in **Sections 3.5.1 to 3.5.8.** The degradate information is presented throughout **Sections 3.5.1 to 3.5.8**, as well as in **Section 3.6**.

Other sources of information, including reviews of the Ecological Incident Information System (EIIS), are conducted to further refine the characterization of potential ecological effects associated with exposure to aldicarb. A summary of the available the incident information for aldicarb is described in **Section 3.7**.

Overall, aldicarb is highly toxic to virtually all animal species tested.

Table 3.7 Measures of Ecological Effects for Aldicarb

Assessment Endpoint		Selected Surrogate Species and Measure of Ecological Effect	Comments
Birds	Survival	Mallard duck oral LD_{50} = 1 mg ai/kg-bw (very highly toxic) Passerine oral LD_{50} = 0.75 mg ai/kg-bw (very highly toxic)	MRID 00107398 MRID 00148695
	Survival	Mallard duck subacute dietary LC_{50} = 594 ppm (moderately toxic) Bobwhite quail subacute dietary LC_{50} = 71 ppm (highly toxic)	MRID 01096727 MRID 00102132
	Reproduction and growth	Mallard duck NOAEC;LOAEC = no established effects Bobwhite quail NOAEC = 1.8 ppm; LOAEL = 8.3 ppm	MRID 48198801 MRID 48156905
Mammals	Survival	Rat LD_{50} = 0.9 mg ai/kg bw (very highly toxic)	MRID 00057333
	Reproduction and growth	Rat NOAEL = 0.4 ppm; LOAEL = 0.7-0.9 ppm	MRID 42148401
Freshwater fish	Survival	Rainbow trout acute 96-hr LC_{50} = 0.560 ppm ai (highly toxic) Bluegill sunfish 96-hr LC_{50} = 0.052 ppm ai (very highly toxic)	MRID 40098001 MRID 40098001
	Reproduction and growth	Fathead minnow NOAEC = 0.078 ppm; LOAEC = 0.156 ppm Effects	MRID 44598601
Freshwater invertebrates	Survival	*Chironomus* acute 48-hr EC_{50} = 0.020 ppm ai (very highly toxic)	Moore *et al.* 1998
	Reproduction and growth	Daphnia NOAEC = 0.020 ppm ai; LOAEC = 0.058 ppm ai	MRID 45592112
Estuarine/marine fish	Survival	Sheepshead minnow LC_{50} = 0.041 ppm ai (very highly toxic)	MRID 40228401
	Reproduction and growth	Sheepshead minnow NOAEC = 0.05 ppm; LOAEC = 0.088ppm	MRID 00066341
Estuarine/marine invertebrates	Survival	Pink shrimp LC_{50} = 0.012 ppm ai (very highly toxic) Oyster 96-hr EC_{50} = 8.8 ppm ai (moderately toxic)	MRID 40228401 MRID 00066341
	Reproduction and growth	Mysid NOAEC = 0.0013 ppm; LOAEC = 0.0015 ppm	MRID 00066341
Terrestrial plants	Survival and growth	Seedling Emergence: >25% effects observed in ryegrass (shoot weight) and tomato (shoot length and weight) in Tier I study No effects to Ryegrass of Tomato in Tier II study using granular TEMIK 15G. Vegetative Vigor: No data but prior waiver was granted	MRID 47904401 MRID 49477401
Insects	Survival	Acute contact LD_{50} = 0.285 ug/bee (highly toxic)	MRID 00036935

Assessment Endpoint		Selected Surrogate Species and Measure of Ecological Effect	Comments
Aquatic plants	Biomass and Growth Rate	7 day Duckweed EC_{50} > 88.7 ppm ai; NOAEC = 5.50 ppm	MRID 47904402
		5 day Marine Diatom EC_{50} > 50 ppm ai	MRID 40228401

LD_{50} = Lethal dose to 50% of the test population; NOAEC = No observed adverse effect concentration; NOAEL = No observed adverse effect level; LC_{50} = Lethal concentration to 50% of the test population; EC_{50} = Effect concentration to 50% of the test population; IC_{50}= concentration resulting in a 50% inhibition in the test population response (*e.g.*, growth)

3.5.1. Toxicity to Birds and Mammals

The acute oral LD_{50} is 1.0 mg/kg-bw for aldicarb and 33.5 mg/kg-bw for aldicarb sulfone. The most sensitive species tested for both chemicals is the mallard duck. Aldicarb and aldicarb sulfone are categorized as very highly toxic and highly toxic to avian species on an acute oral basis, respectively (MRID 00107398). An open literature study provides an acute oral LD_{50} of 0.75 mg aldicarb/kg-bw for passerine species (MRID 00148695).

The most sensitive species tested on a subacute 5-d dietary basis for both aldicarb and aldicarb sulfone is the bobwhite quail. The LC_{50} is 71 ppm for aldicarb and 5706 ppm for aldicarb sulfone. Aldicarb and aldicarb sulfone are categorized as very highly toxic and practically non-toxic to avian species, respectively, based on the subacute dietary exposure data (MRID 00102132 & 01096727, respectively).

Avian reproduction data suggests that aldicarb has reproductive effects at 8.3 ppm with a NOAEC of 1.8 ppm (MRID 48198801). Although none of the endpoints in the treated groups displayed statistically significant differences compared to controls, several of the endpoints had 10-25% difference in the two highest treatments. These endpoints include: number of eggs laid/pen, number of eggs set/pen, number of viable embryos/pen, number of live embryos/pen, number of hatchlings/pen, hatchling survival/pen. In addition, adult body weight gain was also decreased in these treatments. These differences may be biologically significant. Therefore, the NOAEC was 1.8 ppm and the LOAEC was 8.3 ppm.

Acute oral LD_{50} and reproduction data for laboratory rats submitted to the Health Effects Division (HED) for evaluation of human toxicity were used to assess the mammalian acute and chronic toxicity of aldicarb. The LD_{50} for rats is 0.9 mg ai/kg-bw (MRID 00057333). These results classify aldicarb as very highly toxic to mammals on an acute exposure basis. In a 2-generation reproduction study (MRID 42148401), rats were exposed to aldicarb in their diet at concentrations of 0, 2, 5, 10, and 20 ppm. Exposure consistently led to decreased dam body weight gain (parental LOAEL = 0.7 - 0.9 mg/kg-bw; NOAEL = 0.4 mg/kg-bw). Aldicarb treatment also caused lower survivability and pup weights in offspring of all litters (reproductive LOAEL = 1.4 - 1.7 mg/kg-bw; NOAEL = 0.7 - 0.9 mg/kg-bw). These toxicity values are similar to the acute oral LD_{50} mammalian values and suggest that mammals that survive acute aldicarb exposure may suffer adverse reproductive effects from chronic exposure.

3.5.2. Toxicity to Terrestrial Invertebrates

An acute contact study using aldicarb resulted in an LD_{50} of 0.285 µg/bee and the compound was classified as highly toxic (MRID 00036935). Because of its granular formulation, it is unlikely that there is a direct contact exposure scenario for honeybees to granules. Other soil dwelling beneficial insects and invertebrates could be exposed to aldicarb and aldicarb residues through contact with the

granules and/or with plants due to its systemic nature. Honey bees and other terrestrial invertebrates could also be exposed to aldicarb via contaminated pollen and nectar given its systemic nature.

3.5.3. Toxicity to Plants

A seedling emergence study was submitted (MRID 47904401) but was classified as supplemental. The most sensitive monocot species was ryegrass, with a 12 and 44% difference in shoot length and weight, respectively, compared to the control. The most sensitive dicot species was tomato, with a 28 and 25% difference in shoot length and weight, respectively, compared to the control. Phytotoxic effects, including stunting and necrosis, were observed in ryegrass and tomatoes. Based on the observance of >25% effects in ryegrass and tomato, a tier II study with these two species was necessary to fulfill the guideline requirement for 850.4100. A Tier II study (MRID 49477401) on these two species was submitted and resulted in no effects to ryegrass or tomato using granular TEMIK 15G at approved application rates. A vegetative vigor study was not available since a waiver was previously granted for it because the only currently registered products containing aldicarb are granular.

3.5.4. Fish

Since the LC_{50} for fish falls in the range of 52 to 8860 ppb, aldicarb is categorized as very highly to moderately toxic to freshwater fish on an acute basis. The most sensitive freshwater fish species tested for aldicarb was the bluegill sunfish. The LC_{50} for aldicarb was 52 ppb for the bluegill sunfish which is characterized as very highly toxic to freshwater fish [MRID 40098001 and MRID 3503 (Mayer and Ellersieck 1986)]. This same study found an LC_{50} of 560 ppb for the rainbow trout. A supplemental acute toxicity test conducted under static conditions found an LC_{50} for aldicarb of 110 ppb for juvenile bluegill sunfish. Because of the static conditions, it is likely this value reflects contribution of parent aldicarb and its degradates. This study characterized aldicarb as very highly toxic to juvenile bluegill sunfish. A supplemental study from the open literature also concluded that aldicarb was moderately toxic to the fathead minnow *Pimephales promelas* with a reported 48-hour EC_{50} of 8860 ppb (Moore. *et al.* 1998). The LC_{50} of 52 ppb for the bluegill sunfish was used to calculate risk quotients in prior assessments because it was the most sensitive endpoint.

A freshwater fish early life-stage test using aldicarb has been conducted with the fathead minnow. The NOAEC was 78 ppb, the LOAEC was 156 ppb. The most sensitive endpoint was the survival of juveniles after 30-days exposure. [MRID 44598601 also identified as BOWOAL07/4 (Q.H. Pickering and W.T. Gilliam 1982)].

A saltwater fish chronic study was conducted using the sheepshead minnow (MRID 00066341). The NOAEC was 50 ppb, the LOAEC was 88 ppb. The most sensitive endpoint was growth (mean standard length).

3.5.5. Aquatic Invertebrates

An acceptable *Daphnia magna* study determined the EC_{50} to be 410 ppb (Acc #096683, also identified as BOWOAL08, and MRID 00107395), categorizing aldicarb as highly toxic to aquatic freshwater invertebrates on an acute exposure basis. Because this test was conducted under static rather than flow-through conditions, it is likely that this value reflects the contributions of a mixture of parent aldicarb

and various degradates. A supplemental study from the literature reported the LC_{50} of aldicarb to *Daphnia magna, Aedes aegypti, Atermia sp., and Aedes taeniorhynchus* as 75, 290, 5460, and 150 ppb respectively, in 48-hour static tests (Song *et al.*, 1997). A supplemental study from open literature also concluded that aldicarb was very highly toxic to *Daphnia magna* with a reported 48-hour EC_{50} was of 583 ppb (Moore *et al.* 1998). This same study reported a 48-hour EC_{50} of 3990 ppb for *Hyalella azteca* (categorized as moderately toxic) and a reported 48-hour EC_{50} of 20 ppb for *Chironomus dilutus* (formerly known as *C. tentans*). A supplemental study obtained from open literature (Foran *et al.* 1985) determined the 48-hr EC_{50} of juvenile *Daphnia laevis* to be 65 ppb and 51 ppb for adult *Daphnia laevis* categorizing aldicarb as very highly toxic.

Because Moore *et al.* (1998) is classified as a supplemental study of high quality, the 48 hr *Chironomus tentans* EC_{50} value of 20 ppb was used in prior risk characterizations and will continued to be used for this assessment.

A chronic estuarine/marine invertebrate full life-cycle test using aldicarb has been conducted with mysid shrimp. The NOAEC was 1.3 ppb and the LOAEC was 1.5 ppb. The most sensitive endpoint was average number of offspring (MRID 00066341).

3.5.6. Aquatic Plants

A 7-day acute toxicity study with duckweed (*Lemna gibba*) resulted in a LC50 of >88.7 mg ai/L (the highest test concentration). The NOAEC was 5.50 mg ai/L based on effects to frond number, biomass and dry weight at the LOAEC of 14.3 mg ai/L (MRID 47904402). A 5 day study with the diatom produced an EC_{50} of >50 ppm (MRID 40228401).

3.6. Federally-listed Threatened and Endangered Species

In November 2013, the EPA, along with the U.S. Fish & Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS) (collectively, the Services), and the U.S. Department of Agriculture (USDA) released a summary of their joint Interim Approaches for assessing risks to listed species from pesticides. The Interim Approaches were developed jointly by the agencies in response to the National Academy of Sciences' (NAS) recommendations and reflect a common approach to risk assessment shared by the agencies as a way of addressing scientific differences between the EPA and the Services. The NAS report[3] outlines recommendations on specific scientific and technical issues related to the development of pesticide risk assessments that EPA and the Services must conduct in connection with their obligations under the Endangered Species Act (ESA) and FIFRA.

The joint Interim Approaches were released prior to a stakeholder workshop held on November 15, 2013. In addition, the EPA presented the joint Interim Approaches at the December 2013 Pesticide Program Dialogue Committee (PPDC) and State-FIFRA Issues Research and Evaluation Group (SFIREG) meetings, and held a stakeholder workshop in April 2014, allowing additional opportunities for stakeholders to comment on the Interim Approaches. As part of a phased, iterative process for developing the Interim Approaches, the agencies will also consider public comments on the Interim Approaches in connection with the development of upcoming Registration Review decisions. The

[3] http://www.nap.edu/catalog.php?record_id=18344

details of the joint Interim Approaches are contained in the white paper "Interim Approaches for National-Level Pesticide Endangered Species Act Assessments Based on the Recommendations of the National Academy of Sciences April 2013 Report," dated November 1, 2013.[4]

Given that the agencies are continuing to develop and work toward implementation of the Interim Approaches to assess the potential risks of pesticides to listed species and their designated critical habitat, this preliminary risk assessment for aldicarb does not contain a complete ESA analysis that includes effects determinations for specific listed species or designated critical habitat. Although EPA has not yet completed effects determinations for specific species or habitats, for this preliminary assessment EPA conducted a screening-level assessment for all taxa of non-target wildlife and plants that assumes for the sake of the assessment that listed species and designated critical habitats may be present in the vicinity of the application of aldicarb. This screening level assessment will allow EPA to focus its future evaluations on the types of species where the potential for effects exists once the scientific methods being developed by the agencies have been fully vetted. This screening-level risk assessment for aldicarb indicates potential risks of direct effects to all listed taxa with the exception of aquatic plants on some of its registered use sites. Listed species of all taxa may also be affected through indirect effects because of the potential for direct effects on listed and non-listed species upon which such species may rely. Potential direct effects on listed species from the use of aldicarb may be associated with modification of Primary Constituent Elements (PCEs) of designated critical habitats, where such designations have been made. Once the agencies have fully developed and implemented the scientific methods necessary to complete risk assessments for endangered and threatened (listed) species and their designated critical habitats, these methods will be applied to subsequent analyses for aldicarb as part of completing this registration review.

3.7. Endocrine Disruptor Screening Program (EDSP)

As required by FIFRA and the Federal Food, Drug, and Cosmetic Act (FFDCA), EPA reviews numerous studies to assess potential adverse outcomes from exposure to chemicals. Collectively, these studies include acute, subchronic and chronic toxicity, including assessments of carcinogenicity, neurotoxicity, developmental, reproductive, and general or systemic toxicity. These studies include endpoints which may be susceptible to endocrine influence, including effects on endocrine target organ histopathology, organ weights, estrus cyclicity, sexual maturation, fertility, pregnancy rates, reproductive loss, and sex ratios in offspring. For ecological hazard assessments, EPA evaluates acute tests and chronic studies that assess growth, developmental and reproductive effects in different taxonomic groups. As part of the Preliminary Problem Formulation for Registration Review (USEPA, 2012, DP398519), EPA reviewed these data and selected the most sensitive endpoints for relevant risk assessment scenarios from the existing hazard database. However, as required by FFDCA section 408(p), Aldicarb is subject to the endocrine screening part of the Endocrine Disruptor Screening Program (EDSP).

EPA has developed the EDSP to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans or wildlife similar to an effect produced by a "naturally occurring estrogen, or other such endocrine effects as the Administrator may designate." The EDSP employs a two-tiered approach to making the statutorily required determinations. Tier 1 consists of a

[4] http://www.epa.gov/espp/2013/nas.html

battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, or thyroid (E, A, or T) hormonal systems. Chemicals that go through Tier 1 screening and are found to have the potential to interact with E, A, or T hormonal systems will proceed to the next stage of the EDSP where EPA will determine which, if any, of the Tier 2 tests are necessary based on the available data. Tier 2 testing is designed to identify any adverse endocrine-related effects caused by the substance, and establish a dose-response relationship between the dose and the E, A, or T effect.

Under FFDCA section 408(p), the Agency must screen all pesticide chemicals. Between October 2009 and February 2010, EPA issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and 9 inert ingredients. A second list of chemicals identified for EDSP screening was published on June 14, 2013[1] and includes some pesticides scheduled for registration review and chemicals found in water. Neither of these lists should be construed as a list of known or likely endocrine disruptors. Aldicarb is not on List 1. For further information on the status of the EDSP, the policies and procedures, the lists of chemicals, future lists, the test guidelines and Tier 1 screening battery, please visit http://www.epa.gov/endo/.

3.8. Degradate Toxicity

Aldicarb's sulfone and sulfoxide degradates have been shown to be 1 to 2 orders of magnitude less toxic to fish compared with parent aldicarb to aquatic organisms. Minimal difference in toxicity between the parent and degradates was seen for aquatic invertebrates. For more detailed information see the **Appendix A**.

3.9. Incident Database Review

The Ecological Incident Information System (EIIS) and the Incident Data System (IDS) were queried on April 30, 2015. A total of 46 plant and wildlife incidents were in EIIS, 68 domestic animal incidents were in IDS (EIIS does not currently contain information on most of the reported domestic animal incidents), and 283 aggregate incidents have been reported (very little information is reported in aggregate incidents). Many incidents reported in EIIS were associated with intentional poisoning of wildlife. Plant and wildlife incidents are summarized in Table 3.8. Very few incidents that occur are observed or reported to the Agency. Therefore, the number of incidents reported is considered to be a very small fraction of the number of incidents that actually occur. Also, incident reports for non-target organisms typically provide information only on mortality events and plant damage. Sublethal effects in organisms such as abnormal behavior, reduced growth and /or impaired reproduction are rarely reported, except for phytotoxic effects in terrestrial plants.

Uncertainties Related to the Use of Incident Information from the Ecological Incident Information System

Incident data are used in risk assessments to provide evidence that the risk predictions from the screening level assessment are supported by actual effects in the field. [SEQ CHAPTER \h \r 1]Incident reports submitted to EPA since approximately 1994 have been tracked by assignment of incident

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[1] See [HYPERLINK "http://www.regulations.gov/" \l "!documentDetail;D=EPA-HQ-OPPT-2009-0477-0074"] for the final second list of chemicals.

numbers in an Incident Data System (IDS), microfiched, and then the ecological incidents (those with enough detailed information) are entered into a second database, the Ecological Incident Information System (EIIS). Additionally, there is an on-going effort to enter information to EIIS on incident reports received prior to establishment of current databases. Incident reports are not received in a consistent format (*e.g.*, states and various labs usually have their own formats), may involve multiple incidents involving multiple chemicals in one report, and may report on only part of a given incident investigation (*e.g.*, residues).

Incidents entered into EIIS are categorized into one of several certainty levels regarding the likelihood that a particular pesticide is associated with the incident: highly probable, probable, possible, unlikely, or unrelated. In brief, "highly probable" incidents usually require carcass residues and/or clear circumstances regarding the exposure. "Probable" incidents include those where residues were not available and/or circumstances were less clear than for "highly probable." "Possible" incidents include those where multiple chemicals may have been involved and it is not clear what the contribution was of a given chemical. The "unlikely" category is used, for example, where a given chemical is practically nontoxic to the category of organism killed and/or the chemical was tested for but not detected in samples. "Unrelated" incidents are those that have been confirmed to be not pesticide-related.

Incidents entered into the EIIS are also categorized as to use/misuse (the legality of use classifications are registered use, misuse, or undetermined). Unless specifically confirmed by a state or federal agency to be misuse, or there was very clear misuse such as intentional baiting to kill wildlife, incidents are not typically considered misuse.

The number of documented kills in EIIS is believed to be a small fraction of total mortality caused by pesticides. Mortality incidents must be seen, reported, and have reports submitted to EPA to have the potential for entry into the database. Incidents often are not seen, due to scavenger removal of carcasses, decay in the field, or simply because carcasses may be hard to see on many sites and/or few people are systematically looking. Poisoned animals may also move off-site to less conspicuous areas before dying. Incidents may not get reported to appropriate authorities capable of investigating the incident for a variety of reasons including the finder may not know of the importance of reporting incidents, may not know who to call, may not feel they have the time or desire to call, or may hesitate to call because of their own involvement in the kill. Incidents reported may not get investigated if resources are limited or may not get investigated thoroughly, with residue analyses, for example. Also, if kills are not reported and investigated promptly, there will be little chance of documenting the cause, since tissues and residues may deteriorate quickly. Reports of investigated incidents often do not get submitted to EPA, since reporting by states is voluntary.

Furthermore, the database relies heavily on registrant-submitted incident reports, and registrants are currently only required to submit detailed information on 'major' ecological incidents, while 'minor' incidents are reported aggregately.

Based on the 40 CFR (§159.184 Toxic or adverse effect incident reports), an ecological incident is considered 'major' if any of the following criteria are met:

Fish or wildlife*:*

(A) Involves any incident caused by a pesticide currently in Formal Review for ecological concerns.

(B) Fish: Affected 1,000 or more individuals of a schooling species or 50 or more individuals of a non-schooling species.

(C) Birds: Affected 200 or more individuals of a flocking species, or 50 or more individuals of a songbird species, or 5 or more individuals of a predatory species.

(D) Mammals, reptiles, amphibians: Affected 50 or more individuals of a relatively common or herding species or 5 or more individuals of a rare or solitary species.

(E) Involves effects to, or illegal pesticide treatment (misuse) of a substantial tract of habitat (greater than or equal to 10 acres, terrestrial or aquatic).

Plants:
(A) The effect is alleged to have occurred on more than 45 percent of the acreage exposed to the pesticide.

All other ecological incidents are considered 'minor' and only need to be aggregately reported. 'Minor' incidents reported by the registrants are not included in the EIIS database. Therefore, for example, an incident could affect 900 fish, 150 birds, 45 mammals, and 40% of an exposed crop and not be included in the EIIS database [unless is it reported by a non-registrant (*e.g.*, an incident submitted by a state agency – which are not systematically collected)]. Therefore, because the number of documented kills in EIIS is believed to be a small fraction of total mortality caused by pesticides, absence of reports does not necessarily provide evidence of an absence of incidents.

Table 3.8. Incidents Summary for Aldicarb from EIIS

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
Aquatic Incidents in EIIS									
I000165-052	Agricultural Area	Registered Use	Possible	USA	1992	SMALL NUMBER	Soil incorporation	TEMIK	Assumed application of several products onto corn and tobacco crop fields, followed by continuous heavy rains, allegedly resulted in runoff from the fields into surrounded pond causing a fish kill. No other data was reported relative to this incident with the exception of naming the four products applied. Products were Furadan 15G, Nitrogen, Counter Granules and Temik Granules. Due to lack of residue data it is not possible to assign a greater degree of certainty to the cause of this incident. Any of the above could possibly have been responsible for the observed mortalities.
I003826-002	N/R	Undetermined	Possible	USA	1995	UNKNOWN	N/R	TEMIK	The North Carolina Dept. of Agriculture investigated a complaint from the owner of a fish pond in Four Oaks, NC, that pesticides had killed his fish. Dead fish were first noticed on June 8, 1995 but the Dept. of Ag. was not notified until the 12th, and samples of water, soil, sediment, and vegetation were taken on June 13th. Analyses of each were made for pesticides known to have been applied to nearby fields, namely 2,4-D, dimethoate, aldicarb, and disulfoton. All of the water samples gave negative results but one soil sample contained 0.2 ppm dimethoate, and one vegetation sample contained 0.60 ppm aldicarb and its metabolites and 2.5 ppm disulfoton and metabolites. In its response to the complainant, the Dept. of Agri. stated that there had been no violation of the North Carolina Pesticide Law and/or Regulations. It made no mention of the cause of the fish kill, nor did it conduct analyses of the dead fish.
Plant Incidents in EIIS									

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
I010837-012	Cotton	Undetermined	Possible	USA	2000	655 acres of 690		Temik	To comply with 6(a)2 requirements, Novartis reported a complaint from Kingstree, SC, that Ridomil Gold Pc damaged 655 of a 690-acre crop of cotton. TEMIK was another product that was involved and the symptom noted was stand reduction. Here is the verbatim report of the Novartis representative: "This is a field the grower has noticed the fields where RIDOMIL PC was used are not germinating. The stand counts are 13-16 per 25' row. The area is dry, but the seed was at the moisture level. The seed were planted about 1" deep.
I011838-010	Peanut	Undetermined	Possible	USA	2000	ALL	N/R	TEMIK	To comply with 6(a)2 requirements, Valent reported a complaint from Elko, GA, that VALOR damaged all 141 acres of peanuts. Other products used were Sonalan and Temik but no details were given about their use.
I011838-059	Peanut	Undetermined	Possible	USA	2001	78 acres		Temik	To comply with 6(a)2 requirements, Valent reported that a complaint had been received from Lookeba, OK, that VALOR damaged two peanut crops, one being 60 acres and the other 18. Other pesticides involved were TREFLAN PPI and TEMIK but no details of their use were given. The symptoms were "Burnt leaves, wilted growth."
I011838-061	Peanut	Undetermined	Possible	USA	2001	217 and 93 acres		Temik	To comply with 6(a)2 requirements, Valent reported a complaint from Hydro, OK, that VALOR damaged two peanut sites, one of 124 acres and the other 93. PROWL and TEMIK were also applied but no details were given of their use. The symptoms were described as "Burnt terminals & foliage brown."
I011838-085	Peanut	Undetermined	Possible	USA		106 acres		Temik	To comply with 6(a)2 requirements, Valent reported a complaint from Carnegie, OK, that VALOR damaged two sites of peanuts, one of 48 acres and one of 58. Other products used were PROWL and TEMIK but no details were given of their application rates. The symptom was described as "Phytotoxicity: Brown, dead peanuts."
I012089-009	Potato	REGISTERED USE	Possible	USA	2001	ALL	PRE-BROADCAST	TEMIK 15G LOCK 'N	To comply with 6(a)2 requirements, Aventis reported a complaint from Aberdeen, ID, that Temik 15G Lock 'n Load damaged all 1050 acres of a potato crop.
Wildlife Incidents in EIIS									
B0000-400-7	Potato	Misuse (intentional)	Highly Probable	USA	1991		Broadcast, unincorporated	TEMIK	A report of dead sea gulls being found in Hertford County resulted ultimately in a farmer paying a $400 fine for using Temik (aldicarb) in an unpermitted manner, i.e. on a potato field. Three soil samples were taken and found to contain 1.4, 1.8, and 2.5 ppm aldicarb. There were no analyses made of the birds.

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
B000178-001	Bait, carcass/meat	Undetermined	Highly Probable	USA	1988			Temik	A farmer was caught using Temik on sheep carcasses to rid alfalfa field and shelterbelt to kill coyotes. The Fish and Wildlife Service found one dead bald eagle and three dead magpie carcasses. Samples showed Aldicarb in the sheep carcasses at high levels. The farmer also admitted that the sheep carcasses also killed his own 2 dogs, a neighbor's two dogs and another neighbor's single dog after they had gotten into the poisoned carcasses.
I001267-001	Agricultural Area	Misuse (intentional)	Highly Probable	USA	1994		UNKNOWN	TEMIK	Fourteen coyotes and one hawk reported dead due to an insecticide poisoning by a rancher, who was trying to control coyotes that were causing damage to his livestock
I002352-001	Bait	Misuse (intentional)	Highly Probable	USA	1992		Bait	TEMIK	An officer with South Carolina WMR Dept. contacted Special Agent George Hines, U.S. Fish & Wildlife Service (LAW ENFORCEMENT) about wildlife kill by suspected poisoning at the Savannah River Valley Beagle Club near the Edgefield area. Upon visiting the area, they found ten meat patties containing a granular substance along a fence line; also dead, an unspecified number of rabbits, 3 red-tailed hawks, 1 raccoon, 1 grey fox and one opossum covered with granular material within 10 feet of a red-tailed hawk. The Club President and two members admitted placing meat laced with insecticide on the grounds, primarily to control the fox population around the Club. Special Agent Hines submitted specimens for necropsy examination and pesticide analysis to the Southeastern Cooperative Wildlife Disease Study (SCWDS). One red-tailed hawk selected for analysis revealed significant depression of ChE activity. Stomach contents of the animals collected contained partially digested meat and tiny white granules. In particular, an adult male raccoon, weighing 6 lbs 10 oz (Case # 52-92) was too autolyzed postmortem to evaluate, however the stomach had a partially digested meat-like substance with white granules incorporated into it.
I005364-001	COTTON	Misuse (accidental)	Highly Probable	USA			Soil incorporation	TEMIK	Aldicarb was applied to a cotton crop in Joiner, AK, through soil incorporation. But, because of leakage from the applicator tank, several dogs and a raccoon came into contact with the pesticide and died. The owner of one of the dogs complained that EPA should not allow such a toxic compound to be on the market.
I007372-003	WOODLANDS	Misuse (intentional)	Highly Probable	USA	1997		N/R	TEMIK	This incident involved intentional pesticide poisoning in the area around Willow Grove. Land there is used for hunting in woodlands and normal winter weather prevailed. Animal species were targeted.

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
I010439-001	Agricultural Area	Misuse (intentional)	Highly Probable	USA	2000		Bait	TEMIK	To comply with 6(a)2 regulations, Aventis reported the death of a coyote and an opossum in the early part of June, 2000, in Pearl River County, MS. Raw hamburger meat had been laced with TEMIK and placed beside the carcass of a dead calf in a pasture, presumably as a target for coyotes. An opossum and a coyote died as the result of eating this bait. Aventis was cooperating with the MS Bureau of Plant Industry in prosecuting the case.
I011300-001	N/R	Misuse (intentional)	Highly Probable	USA	2001		Bait	N/R	The Southeastern Cooperative Wildlife Disease Study reported that a ranger of the GA Dept. of Natural Resources found a dead Cooper's hawk on the grounds of a private hunting club. The dead bird had a piece of meat in its mouth and was lying near a dead mouse and three other pieces of meat suspected to be bait. Analyses of the bird showed 14 ppm aldicarb in its liver, and 1227 ppm in the GI contents. Concentrations of aldicarb in the meat found in the mouth, and of the other bait items, ranged from 630 ppm to 2610 ppm.
I013168-001	Agricultural Area	Misuse (intentional)	Highly Probable	USA	2002		Bait		An e-mail was received from the American Bird Conservancy that told of the outcome of the prosecution against a Tennessee man for illegally using TEMIK (aldicarb) to kill birds. He was charged with nine counts of violating the Migratory Bird Treaty Act and one count of the Federal Insecticide, Fungicide, and Rodenticide Act. This was the first indictment achieved by the Western Tennessee Environmental Task Force. The victims of this killing were seven red-tailed hawks and two black vultures
I013928-001	Bait, carcass/meat	Misuse (intentional)	Highly Probable	USA	2003		Bait		A yellow-rumped warbler and a red fox were found dead. Aldicarb is identified as the cause of death of these animals death, as aldicarb-laces hamburger bait was present near where the dead bird and fox were found. A few granules found in the birds' gastrointestinal tract were similar to the granules seen in the contaminated bait. Brain tissue of the warbler was negative for West Nile virus. Bait tested positive for aldicarb with a measured concentration of 2,970 ppm. Aldicarb residues were also detected in the fox's gastrointestinal contents (20.8 ppm) and liver (10.0 ppm).

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
I013932-001	Bait	Misuse (intentional)	Highly Probable	USA			Bait		Two living dogs at a residence within 200 yards of an area being used for grazing by a wool grower in Imperial County became ill and required medical attention. The veterinarian suspected that the animals had been poisoned based on the observed symptoms. One of the dogs regurgitated its stomach contents which appeared to consist of at least one partially digested hotdog. It was suspected that illegal baits were being placed in the area to try and poison coyotes that may have been predating the sheep adjacent to the residence. The stomach contents were determined to contain residues of the carbamate insecticide aldicarb at a concentration of 8,000 ppm. Consultation with University of California veterinarians and toxicologists concluded that the concentration of the poison was high enough to almost immediately trigger a regurgitation response in one of the dogs so that most of the pesticide was eliminated from the body before it could be absorbed. Carbamate insecticides act to depress cholinesterase and acetyl-cholinesterase activity. The symptoms observed in the two dogs are consistent with exposure to carbamate insecticides. It is highly likely that the concentration of aldicarb present in the sample would prove lethal to any non-target wildlife the might have consumed the bait.
I016407-062	Bait	Misuse (intentional)	Highly Probable	USA	2005		Bait	Temik	To comply with 6(a)2 requirements, Bayer reported an incident the subject of which is contained in a report from the Fish and Wildlife Service which recounts the death of a wolf that was caused by Temik, a Bayer product. The report states "USFWS found a dead wolf six miles into the Frank Church Wilderness of Idaho. Wolf was radio collared. Had been dead for less than two weeks. A butterflied shrimp steak was collected as evidence, with gray granules inside the split. Visual comparison with blank aldicarb sample previously provided by State Affairs appeared to confirm Temik. USFWS commented that there was 'lots of Temik' inside the split meat. USFWS lab analysis confirms aldicarb. Meat evidently was not spoiled, which supports belief that this is a fresh, 2005 case, and not carryover from previous experiences."

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
I017085-001	Bait	Misuse (intentional)	Highly Probable	USA	2006		Bait		This incident begins with a man finding his dog severely sick on Jan. 3, 2006 in Floyd County, GA. The following day, his other dog was found dead near his home. A ranger of the Georgia Dept. of Natural Resources, the next day, found two opossum carcasses in the same area where the dog had died. Necropsies were performed on the two opossums; the GI contents of one of them contained 96 ppm of aldicarb and the other contained 185 ppm aldicarb. Further study led to the discovery of a dead white-tailed deer that had been dumped on the property. The ranger investigating the deaths feels that the deer, too badly decomposed to analyze for pesticide residues, was the source of the aldicarb in the animals that were killed. He said that Temik was not sold locally, and that the main crop grown in the area was corn, for which Temik is not registered. He suspects that the deer carcass was baited with aldicarb and placed to kill coyote.
I017462-001	N/R	Misuse (intentional)	Highly Probable	USA	2006				One dog and two black vultures were found near a partially-consumed carcass of a cottontail rabbit. The incident occurred on municipal property that was used by the town of Hoinsville for disposal of wastewater from a sewage treatment plant. Analysis of the vulture and rabbit found that brain cholinesterase levels were significantly depressed in both animals, indicating that both had ingested an anticholinesterase chemical. Toxicological analysis found 43 ppm aldicarb in the stomach of the rabbit and "greater than 0.1 ppm" of aldicarb sulfoxide in the liver of the vulture. The testimony of a local GA DNR employee as well as GIS analysis done by EFED indicated that very little or no land in the vicinity was planted in crops on which aldicarb is registered for use. Thus, while there is little doubt that the animals were poisoned by aldicarb, the most likely scenario is that the animals were poisoned by illegal baiting or some other illegal use of aldicarb.
I019647-014	Bait, carcass/meat	Misuse (intentional)	Highly Probable	USA	2008		Bait	Temik	Temik product with active ingredient Aldicarb used for illegal bait at a hunting club, causing mortality to approximately 10 hawks and an unspecified number of vultures. Additional animals may have been involved. Samples of the baited deer carcass were taken by a state Lab and confirmed to contain aldicarb.
I019647-015	Bait, carcass/meat	Misuse (intentional)	Highly Probable	USA	2008	30-35	Bait	Temik	S Fish and Wildlife service investigated the mortality incidents in woods in Montgomery County, AR involving 30-35 birds, including hawks, and other unspecified species. Mortality of birds and other species occurred due to intentional misuse of Temik product by baiting. Samples have been taken to lab and in most cases confirmed the presence of aldicarb.

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
I019647-016	Bait, carcass/meat	Misuse (intentional)	Highly Probable	USA	2008	20-25	Bait	Temik	Illegal baiting of eggs spiked with Temik (a.i. aldicarb) caused extensive wildlife mortality in McDuffie County, Georgia. A total of 20-25 dead animals were observed. Animals that were identified were 3 red tail hawks, 3 grey fox, 2 opossums, 1 coyote, and a beagle. Georgia Department of Natural Resources and Enforcement is investigating the incident. One individual has confessed. Two of the eggs placed for bait contained were analyzed and found to contain 1200 ppm and 22,000 ppm of aldicarb. Aldicarb was also found in the stomach contents of the coyote (240 ppm) and the beagle (220 ppm).
I019925-001	Bait	Misuse (intentional)	Highly Probable	USA	2008		Bait		Georgia Department of Natural Resources reported mortality of a coyote and over 25 other wild animals Hancock County, Georgia. The cause was diagnosed as aldicarb toxicosis based on detection of 240 ppm aldicarb in the stomach contents of the coyote. Two broken eggs found at the site were also tested and found to contain 1,200 and 22,000 ppm of aldicarb. This appears to be a case of someone illegal baiting with aldicarb to intentionally kill wildlife.
I021411-012	Bait, grain/seed	Misuse (intentional)	Highly Probable	USA	2008	Several	Bait	TEMIK	A peanut field in Eastland County, TX, was baited with corn soaked in the product TEMIK (a.i. aldicarb) most likely resulted in the death of an unspecified number of deer, opossum, skunks, feral hogs, various birds with possible hawk and turkey buzzard.
I022570-001	Rural	Misuse (intentional)	Highly Probable	USA	2010			Temik	South Carolina authorities said they are working to determine who and prosecute those responsible for killing four hunting dogs and causing some dozen hunters to go to a Kershaw County hospital on Dec. 30, 2010 after they were exposed to an illegal application of the product Temik (a.i. aldicarb) along hunting trails.
I026114-001	N/R	Undetermined	Highly Probable	USA					The carcass of a 2 1/2 year old male, adult golden eagle collected near a power line on December 11, 2013 was submitted to the Southeastern cooperative Wildlife Disease. The final diagnosis by the Southeastern cooperative Wildlife Disease Study was aldicarb (carbamate) intoxication. Toxicology testing detected aldicarb, a carbamate insecticide, in the crop contents of this individual. Although this assay does not quantify the concentration of aldicarb present and does not confirm the chemical in the tissues of the bird itself, the compound is highly toxic, which makes it likely that intoxication was the cause of death.

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
I008694-001	Bait	Misuse (intentional)	Possible	USA	1998		Bait	TEMIK	Rhone-Poulenc notified OPP of the intentional poisoning of a golden eagle in Alabama by TEMIK. According to a handwritten note at the bottom of a newspaper clipping concerning the event, the U.S. Fish and Wildlife Service called Rhone-Poulenc to tell the company of the incident in question. A hunting-camp caretaker (Marengo County) allegedly tried to clear out the coyotes, presumably by lacing deer carcasses with TEMIK. Here is a direct quote from a newspaper account: "On February 10, 1998, hunters found a dead golden eagle lying near two deer carcasses which were later tested for poisons. The U.S.Fish and Wildlife Service investigated the case." At the time of the newspaper publication (Feb.11, 199) the results were not yet available. According to the newspaper account the TEMIK had been in a Mason jar in a closet in the home of the accused, and his wife had thought the contents were ant poison. The accused pleaded innocent to the misdemeanors. Rhome-Poulenc stated this was an update to an earlier submission, I008381-001
I017141-001	Bait, carcass/meat	Misuse (intentional)	Possible	USA	2006			Temik	In Georgia, a deer carcass laced with aldicarb most likely caused the death of two opossums and two domestic dogs. The product used was most likely Temik, however it is not sold locally and was used illegally. The two possums were analyzed, and aldicarb was found at 96 ppm in one and 185 ppm in the other - with no other organic insecticides found at a concentration greater than detectable limits (0.1ppm).
I000637-001	RANGELAND	Misuse (intentional)	Probable	USA	1993	N/R	N/R	TEMIK	According to the report animal fat was laced with Aldicarb and used as bait in order to control animals on a ranch. As a result it was alleged that dogs, and an unknown number of cats, chickens, cardinals and owls suffered mortality. No carcass analyses were made. The precise event dates were not reported; they were estimated to extend from 01/01/93 through 03/31/93.

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
I000799-005	Potato	Misuse (intentional)	Probable	USA	1991		N/R	TEMIK 15G	According to the report the investigators alleged that a potato field was treated with aldicarb. The treatment allegedly resulted in a bird kill. The farmer stated he had used no aldicarb on his potato field, only on tobacco. He said he used metolachlor on his potatoes. He had dusted potato seeds with captan before planting. Three soil samples revealed the presence of aldicarb but no other pesticide, Rain followed the observation of neighbors who observed the aldicarb application. Witnesses wanted to remain anonymous; this handicapped the investigation. Stomach content of one seagull revealed inconclusive results because the sample was too small. Three cats and one dog also suffered mortality during this event. It was emphasized that the applicator failed to follow packaging guidelines for safe handling of the pesticide. The NC Ag. Dept. ruled the event a misuse because the labeling of aldicarb states: "No longer labelled for use on potatoes."
I007595-001	Bait	Misuse (accidental)	Probable	USA	1998	UNKNOWN	Bait	TEMIK 15G	While cleaning out the pickup truck of a deceased father, the sons found a metal salt and pepper shaker which they passed around to season raw cabbage shared with friends. About 15 persons became ill, but recovered. Dr. Katrin KOHL of LA Office of Public Health was informed by RP Environmental Affairs that the material involved was likely illegally obtained. She then confirmed that a son reported that his father routinely baited fish heads to kill raccoons around their crawfish ponds, in the city of Ville Platte, LA.
I010439-002	Bait, carcass/meat	Misuse (intentional)	Probable	USA	2000		Bait	TEMIK	It was reported an intentional misuse of TEMIK in Hancock County, MS, in July, 2000. Witnesses stated that a suspect from Louisiana injected FURADAN into eggs and mixed TEMIK into meat to serve as bait for predators that eat quail eggs. State officials collected samples from five baiting sites following the reported deaths of a hunting dog, a raccoon, and a buzzard.
I011213-007	Bait	Misuse (intentional)	Probable	USA	2001		Bait	TEMIK 15G	To comply with 6(a)2 requirements, Aventis CropScience reported an intentional misuse of TEMIK 15G Brand Aldicarb Pesticide. Persons in southwestern Virginia were illegally raising chickens for cock fighting, and baited a carcass with the product and placed it onto a fence for predator control. A great horned owl died as the result of this act.
I014343-001	N/R	Undetermined	Probable	USA	2003				Two dead black vultures were found dead near the old radio on Highway 17 in Guyton, GA. Brain tissue for both birds tested negative for West Nile virus. Tissue, brain and stomach contents were sent out for testing. Bird A had 12.2 micromoles/gram/minute for cholinesterase activity and Bird B had 5.1 micromoles/gram/minute. Bird B showed 0.81 ppm of aldicarb, there was no analysis given for Bird A.

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
I019363-003	Bait, carcass/meat	Misuse (intentional)	Probable	USA	2008		Bait	Temik 15G	Temik product with active ingredient aldicarb was applied to an animal carcass as an illegal bait in Pike county, Alabama. This resulted in unspecified adverse effects to 2 dogs and 3 possums. The incident is being investigated by both the Houston County Sherriff Department and by Alabama Department of Agriculture and Industries. Bait was presented in two ways, granules applied to blocks of animal fat and as an oily mix applied to an animal carcass. Samples of the baited meat as well as the oily substance applied to the carcasses has been taken and will be analyzed by the Alabama state Labs.
I025850-002	Rural	Misuse (intentional)	Highly Probable	England	2013			N/R	A red-kite hawk fell victim to illegal poisoning by a lethal pesticide, most probably laced on baits left out in the countryside. The red-kite was discovered dead in Old Leake, Boston, Lincolnshire in May, 2013. Toxicology tests run by the government's Wildlife Incident Investigation Scheme confirmed that the banned pesticide, aldicarb, was used to poison the bird.
I021543-001	N/R	Misuse (intentional)	Highly Probable			Seven species	Bait	Aldicarb	Newsessentials.blogspot.com/2009 reports, Dec. 27, 2009, according to the group Ezemvelo Kwazulu-Natal Wildlife, seven of the nine species of Africa vulture are considered endangered. The scarceness is a belief in East coast and West Africa. One cause is poison with the pesticide Aldicarb. The nyanga, medicine man of South Africa region say that the blue meat shows that it is poisoned.
I023173-002	NR	Misuse (intentional)	Probable		2011		Animal treatment		Scotsman.com News, on Aug. 25, 2011 reported that one peregrine falcon was found dead during April at a quarry in Scotland. Police believe the act to be a deliberate, criminal poisoning probably caused by aldicarb.
I025850-001	N/R	Misuse (intentional)	Highly Probable	England	2013	2 Harriers		N/R	A pair of marsh harriers have fallen victim to illegal poisoning by a lethal pesticide, most probably laced on baits left out in the countryside. The pair of marsh harriers were discovered dead adjacent to the Nene Washes Nature Reserve, Cambridgeshire in April. Toxicology tests run by the government's Wildlife Incident Investigation Scheme confirmed that the banned pesticide, Aldicarb, was used to poison the birds.
I023356-001	N/R	Misuse (intentional)	Probable	England			Animal treatment		BBC News online www.bbc.co.uk/news/uk-england reported on Oct,21, 2011 that one female peregrine falcon was found dead in July at a quarry near Bucksfastleigh, England. Police and RSPB believe the act deliberate criminal poisoning using live bait possibly using aldicarb and carbofuran pesticides.

Incident ID	Use Site	Legality	Certainty	Country	Year	Total Magnitude	Appl. Method	Product	Summary (Taken Directly from Incident Reports)
I015916-001	Quarry	Misuse (intentional)	Probable	Great Britain	1999		Bait		There is a Department for Environment, Food and Rural Affairs in Great Britain which publishes a newsletter oriented toward instances of pesticide abuse. In its July, 2001 issue it tells of peregrine falcons being killed at a quarry near Plymouth. Aldicarb-laced pigeon carcasses were lowered onto a peregrine nest-ledge by means of a fishing line, resulting in the deaths of at least one adult and two young peregrines. No analyses of the victims were mentioned, but the presumption is that their deaths were due to the carcasses laced with aldicarb.
I024836-022		Undetermined	Possible	Scotland	2011	1		N/R	In April 2011 a buzzard was found dead of aldicarb and carbofuran abuse in Scotland, The laboratory investigation confirmed the presence of carbofuran residues of the carbamate insecticides, aldicarb and carbofuran, in tissue samples analyzed from this bird. However, no further police investigation has been undertaken due to a lack of evidence.
I023173-001	N/R	Misuse (intentional)	Probable	Scotland	2011		N/R		Scotsman.com News, on Aug. 25, 2011 reported that one peregrine falcon was found dead in April, at a quarry in a Kirknewtown, Scotland. Police believe the act to be deliberate act of criminal poisoning probably caused by aldicarb. State that one of the heads kept as trophy

4. RISK CHARACTERIZATION and RISK DESCRIPTION

4.1. Terrestrial Animals

In September 2007, the Agency issued a Reregistration Eligibility Decision (RED) for aldicarb ([HYPERLINK "http://www.epa.gov/oppsrrd1/REDs/aldicarb_red.pdf"]). Key conclusions on exposure and risks to terrestrial and aquatic wildlife as well as relevant data gaps as they relate to these two assessments are listed below. RQs using alternative application rates and incorporation efficiencies ([HYPERLINK "http://www.regulations.gov/" \l "!documentDetail;D=EPA-HQ-OPP-2005-0163-0156"] and http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2005-0163-0203) were calculated later under addenda to the RED document. These RQs took into account the 99% soil incorporation rates of the specialized application equipment that is used to apply aldicarb. The assessment was updated to reflect current maximum label rates, and the methodology is considered to provide reasonable estimates of potential risks. Risk conclusions remain unchanged from previous assessments. The analysis remains an adequate refined description of the potential risks to terrestrial wildlife.

The following table reports the risk quotients for birds and mammals exposed to aldicarb applied at maximum application rates and 99 percent granule incorporation efficiency. This analysis was performed to better characterize risk in the aldicarb ecological risk assessment. The RQs are expressed in terms of LD_{50}/ft^2, which is the current approved risk metric for granular formulations. Conceptually, an LD_{50}/ft^2 is the amount of a pesticide estimated to kill 50% of exposed animals in each square foot of applied area. Although a square foot does not have defined ecological relevance, and any unit area could be used, risk presumably increases as the LD_{50}/ft^2 value increases. The $LD50/ft^2$ value is used to estimate risk for granular formulations and row, banded, and in-furrow applications. For additional information on the LD_{50}/ft^2 risk index, please refer to USEPA, 1998.

Table 4.1. Refined RQs from the 2007 RED: Acute avian RQs for 99 percent incorporation efficiency at maximum application rates. (Note that changes in the maximum application rate since the 2007 Analysis are incorporated into the assessment)

Crop Scenario	Bird Type	Rate (lbs ai/A)	RQ (99% incorporated)
Cotton Banded/Sidedress 4" band width 40" row spacing	Small Bird Medium Bird Large Bird	2.1	220 35 2.7
Dry Beans Banded 6" band width 48" row spacing	Small Bird Medium Bird Large Bird	2.1	175.5 27.6 1.9
Peanuts Banded 6" band width 36" row spacing	Small Bird Medium Bird Large Bird	3.0	160 25 1.8
Pecans Broadcast	Small Bird Medium Bird Large Bird	1.05	104.9 16.5 1.2
Potatoes Banded 6" band width 38" row spacing	Small Bird Medium Bird Large Bird	3.0	198.5 31.2 2.2
Soybeans Banded	Small Bird Medium Bird		55 9

6" band width 30" row spacing	Large Bird	3.0	0.6
Sugar Beets Banded 6" band width 22" row spacing	Small Bird Medium Bird Large Bird	 4.95	189.6 29.8 2.1
Sweet Potatoes Banded 12" band width 48" row spacing	Small Bird Medium Bird Large Bird	 3.0	124.8 19.6 1.4

Mallard duck LD_{50} = 1 mg/kg- bw

Table 4.2. Refined RQs from the 2007 RED: Acute mammalian RQs for 99 percent incorporation efficiency at maximum application rates. (Note that changes in the maximum application rate since the 2007 Analysis are incorporated into the Assessment)

Crop Scenario	Mammal Type	Rate (lbs ai/A)	RQ (99% incorporated)
Cotton Banded/Sidedress 4" band width 40" row spacing	Small Medium Large	 2.1	73 40 4
Dry Beans Banded 6" band width 48" row spacing	Small Medium Large	 2.1	59.3 31.4 2.5
Peanuts Banded 6" band width 36" row spacing	Small Medium Large	 3.0	32 17 1
Soybeans Banded 6" band width 30" row spacing	Small Medium Large	 3.0	19 9.8 0.8
Sugar Beets Banded 6" band width 22" row spacing	Small Medium Large	 4.95	64 33.9 2.7
Sweet Potatoes Banded 12" band width 48" row spacing	Small Medium Large	 3.0	42.1 22.3 1.8

Rat LD_{50} = 0.9 mg/kg-bw

4.1.1. Additional Terrestrial Animal RQ Refinements

Assumptions of incorporation efficiency (Bayer Crop Science and EPA) did not reduce the level of risk to avian and mammalian species below the Level of Concern (LOC). EFED modeled 99% (for banded/sidedress), 99.5% (banded/sidedress and in-furrow) and 99.9% (banded/sidedress and in-furrow) incorporation efficiency at EPA typical application rates (as defined at the time of the RED) to investigate whether such assumptions, albeit unrealistic, would reduce the risk to below LOC for terrestrial wildlife. None of the modeling scenarios decreased the avian or the mammalian risk beyond Agency levels of concern for any of the crops. The tables below list the crops, application rates, application methods and RQs for avian and mammalian species.

Table 4.3. Recalculated acute avian RQs for different incorporation efficiencies at typical application rates with different incorporation efficiencies

Crop Scenario	Bird Type	Typical Application				
		Rate (lbs ai/A)	RQ (85% incorporated)	RQ (99% incorporated)	RQ (99.5% incorporated)	RQ (99.9% incorporated)
Cotton[1] Banded/Sidedress 4" band width 40" row spacing	Small Bird Medium Bird Large Bird	0.6 0.6 0.6	*947.5* *148.9* *10.5*	**60.2** **9.5** **0.7**	**30.1** **4.7** 0.3*	**6.0** **1.1** 0.7
Dry Beans Banded 6" band width 48" row spacing	Small Bird Medium Bird Large Bird	1.0 1.0 1.0	*1247.6* *196.0* *13.4*	**80.2** **12.6** **0.9**	**40.1** **6.3** **0.5**	**8.0** **1.3** 0.09
Peanuts Banded 6" band width 36" row spacing	Small Bird Medium Bird Large Bird	0.9 0.9 0.9	*842.1* *132.2* *9.4*	**54.2** **8.5** **0.6**	**27.1** **4.3** 0.3*	**5.4** **0.9** 0.06
Soybeans Banded 6" band width 30" row spacing	Small Bird Medium Bird Large Bird	0.7 0.7 0.7	*545.8* *85.8* *6.1*	**35.1** **5.5** 0.4*	**17.6** **2.8** 0.2*	**3.5** **0.6** 0.04
Sugar Beets Banded 6" band width 22" row spacing	Small Bird Medium Bird Large Bird	1.8 1.8 1.8	*972.1* *152.7* *10.8*	**66.2** **10.4** **0.7**	**33.1** **5.2** 0.4*	**6.6** **1.1** 0.07
Sweet Potatoes Banded 12" band width 48" row spacing	Small Bird Medium Bird Large Bird	1.4 1.4 1.4	N/A N/A N/A	***58.2*** ***9.2*** ***0.7***	**28.1** **4.4** 0.3*	**5.6** **0.9** 0.1**

Mallard duck LD50 = 1 mg/kg- bw; Rat LD50 = 0.9 mg/kg-bw

[1]99% incorporation efficiency is non-achievable for post-emergent applications and for trees

Italicized numbers are RQs published in May 2006 RED; un-italicized represent RQs from new modeling scenarios.

Bold RQs = acute and chronic LOC exceedances for non-listed species; * = restricted use LOC exceedances; ** = listed LOC exceedances

Table 4.4. Recalculated acute mammalian RQs for different incorporation efficiencies at typical application rates with different incorporation efficiencies

Crop Scenario	Mammal Type	Typical Application				
		Rate (lbs ai/A)	RQ (85% incorporated)	RQ (99% incorporated)	RQ (99.5% incorporated)	RQ (99.9% incorporated)
Cotton[1] Banded/Sidedress 4" band width 40" row spacing	Small Bird Medium Bird Large Bird	0.6 0.6 0.6	*320.1* *169.6* *13.7*	**21.1** **11.2** **0.9**	**10.5** **5.6** **0.5**	**2.1** **1.1** 0.09
Dry Beans Banded 6" band width 48" row spacing	Small Bird Medium Bird Large Bird	1.0 1.0 1.0	*421.5* *223.3* *18.1*	**28.1** **14.9** **1.2**	**14.0** **7.4** **0.6**	**2.8** **1.5** 0.1**
Peanuts Banded 6" band width 36" row spacing	Small Bird Medium Bird Large Bird	0.9 0.9 0.9	*284.5* *150.7* *12.2*	**19.0** **10.0** **0.8**	**9.5** **5.0** 0.4*	**1.9** **1.0** 0.08
Soybeans Banded 6" band width 30" row spacing	Small Bird Medium Bird Large Bird	0.7 0.7 0.7	*184.4* *97.7* *7.9*	**12.3** **6.5** **0.5**	**6.1** **3.3** 0.3*	**1.2** **0.7** 0.05
Sugar Beets Banded 6" band width 22" row spacing	Small Bird Medium Bird Large Bird	1.8 1.8 1.8	*328.4* *174.0* *14.1*	**23.2** **12.3** **1.0**	**11.6** **6.1** **0.5**	**2.3** **1.2** 0.1**
Sweet Potatoes Banded 12" band width 48" row spacing	Small Bird Medium Bird Large Bird	1.4 1.4 1.4	N/A N/A N/A	***19.7*** ***10.4*** ***0.8***	**9.8** **5.2** 0.4*	**2.0** **1.0** 0.08

Mallard duck LD50 = 1 mg/kg- bw
Rat LD50 = 0.9 mg/kg-bw
Italicized numbers are RQs published in May 2006 RED; un-italicized represent RQs from new modeling scenarios.
Bold RQs = acute and chronic LOC exceedances for non-listed species; * = restricted use LOC exceedances; ** = listed LOC exceedances
[1]99% incorporation efficiency is non-achievable for post-emergent applications and for trees

4.1.2. Risk Conclusions for Terrestrial Organisms

- The weight of evidence suggests that there is considerable risk to non-target wildlife from all uses of aldicarb. Bird and mammal RQs exceed levels of concern for all labeled uses; and additional lines of evidence such as incidents and the inherent toxicity of the chemical suggest that aldicarb application does result in impacts to wildlife. Even assuming lower than the maximum application rate (typical rates) and availability of a fraction of the chemical is available for consumption due to burial does not result in risk below concern levels. Ingestion of a single granule is sufficient to result in mortality to birds and mammals since LD_{50s} for birds and mammals were basically the same with values of 0.9 mg ai/kg-bw for mammals and 0.75 to 1.0 mg ai/kg-bw for birds. In a study on the red-winged blackbird, technical and granular (Temik 15G) aldicarb yielded similar LD_{50} values. Balcomb et al. (1984) measured the acute oral toxicity of aldicarb to two species of song bird (house sparrow and red-winged blackbird). When birds were dosed with varying numbers of aldicarb granules (Temik 15G), 40% of blackbirds (5 birds tested at each concentration) given a single granule died, and 80% of those given 5 granules died. In house sparrows, 40% died after ingesting 1 granule and 83% died after consuming 5 granules (6 birds tested at each concentration). Birds died within 15 to 18 minutes of granule ingestion. Since there were risks to birds, reptiles may also be at risk.

- Granules left exposed on the surface appear to be the main source of exposure, but other sources such as residues of aldicarb taken up by plants and soil invertebrates (*e.g.*, earthworms) may also serve as a means of exposure. Drinking water may also be an exposure route of concern. Bunyan et al. (1981) conducted an extensive field trial with sampling of invertebrates, birds, and small mammals around fields of sugar beet treated in furrow with aldicarb granules (10% ai) at 1.12 kg aldicarb per ha. High levels of residues in blackbirds and two small mammals trapped within the treated field, as well as a dead partridge, indicated to the authors that the most significant hazard of aldicarb was from direct ingestion of non-incorporated granules soon after application. A secondary hazard involved aldicarb-poisoned earthworms that came to the surface of the soil particularly in wet conditions. Worms containing residues were found 2-6 days after drilling. Low residues of aldicarb were found in herbivores eating young plants that had systemically absorbed aldicarb. Residues and reduced esterase activity in brain were found in a number of bird species feeding on the ground, indicating that exposure to aldicarb can be widespread in the case of granular applications.

- Reduction in growth to non-target terrestrial plants from runoff could not be assessed because of the lack of toxicity data. However, Tier 1 seedling emergence studies and incident data suggest that aldicarb could affect some non-target plants.

- There are expected risks to bees; although aldicarb has granule applications, it is systemic and can be available to bees in plants via pollen and/or nectar. Also, bee incidents have been reported. Data gaps (see **Section 5**) prevent a full assessment of risks to bees.

4.2. Aquatic Species

Parent aldicarb and its degradates are highly mobile and are known to move to ground water in sandy acidic soils. In poorly permeable soils, it will move with runoff. Following a rain event, aldicarb may reach aquatic environments as sheet and channel flow from areas of application, since aldicarb is

moderately persistent in terrestrial environments and soluble in water. It is unlikely, though, that undissolved granules will reach surface water bodies as the granules themselves are not particularly mobile and in most cases buried below the surface. Aldicarb residues are likely to create concern for fish and aquatic invertebrates (as well as amphibians) in low-order streams because these streams are dominated by base flow conditions (where 100% of stream flow consists of discharged ground water), and most of the toxic residues are believed to form within the subsurface (especially within the saturated zone, where conditions are more like to be alkaline) and are conveyed by ground water. Higher-order streams are sustained by much larger contributing land areas, so there should be a greater dilution effect. Higher incorporation efficiencies would reduce risks to aquatic organisms. However, under the current label scenarios modeled for EECs, all aquatic organism acute and chronic RQs exceeded all LOCs for all current uses. However, there were no LOC exceedances for aquatic plants.

4.2.1. Revised RQs resulting from EECs from currently supported (2015) uses

Table 4.5. Aquatic Exposure Estimates for Fish from Aldicarb Use Sites (Aldicarb Only)[A]

Use Site	SWCC Scenario	1-in-10-year Peak (µg/L)	1-in-10-year 21-day Mean (µg/L)	1-in-10-year 60-day Mean (µg/L)
Cotton	MS cotton	28.9	25.7	19.9
Dry Beans	MI beans	28.2	26.4	21.8
Peanuts	NC peanuts	17.4	14.7	11.8
Soybeans	MS soybeans	22.3	19	13.2
Sugar Beets	MN sugar beets	**53**	**47.7**	**36.8**

[A] Maximum values are in bold.

Table 4.6. Aquatic Exposure Estimates for Aquatic Invertebrates from Aldicarb Use Sites (Aldicarb TTR)[A]

Use Site	SWCC Scenario	1-in-10-year Peak (µg/L)	1-in-10-year 21-day Mean (µg/L)	1-in-10-year 60-day Mean (µg/L)
Cotton	MS cotton	35.1	28.3	17.7
Dry Beans	MI beans	30.6	26.4	18.2
Peanuts	NC peanuts	21.1	15.6	10
Soybeans	MS soybeans	26.7	20.1	11.3
Sugar Beets	MN sugar beets	**78**	**59.7**	**38**

[A] Maximum values are in bold.

Table 4.7. Acute and chronic RQs for freshwater fish using maximum application rates with 99% incorporation efficiency

Crop Use	LC50 (ppb)	NOAEC (ppb)	EEC Initial/Peak (ppb)	EEC 60 day average (ppb)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/ENEC)
Cotton	52	0.46	28.9	19.9	**0.55**	**43.26**
Dry Beans	52	0.46	28.2	21.8	**0.54**	**47.40**
Peanuts	52	0.46	17.4	11.8	**0.33**	**25.65**
Soybeans	52	0.46	22.3	13.2	**0.43**	**28.70**
Sugar Beets	52	0.46	53	36.8	**1.02**	**80.00**

Bluegill sunfish LC50 = 52 ppb
Bluegill sunfish ENEC = 0.46 ppb

Table 4.8. Acute and chronic RQs for freshwater inverts using maximum application rates with 99% incorporation efficiency

Crop Use	LC50 (ppb)	NOAEC (ppb)	EEC Initial/Peak (ppb)	EEC 21 day average (ppb)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/NOAEC)
Cotton	20	1	35.1	28.3	**1.75**	**28.30**
Dry Beans	20	1	30.6	26.4	**1.53**	**26.40**
Peanuts	20	1	21.1	15.6	**1.05**	**15.60**
Soybeans	20	1	26.7	20.1	**1.33**	**20.10**
Sugar Beets	20	1	78.0	59.7	**3.90**	**59.70**

Chironomus tetanus LC50 = 20 ppb
Mysidopsis bahia NOAEC = 1.0 ppb

Table 4.9. Acute and chronic RQs for estuarine/marine fish using maximum application rates with 99% incorporation efficiency

Crop Use	LC50 (ppb)	NOAEC (ppb)	EEC Initial/Peak (ppb)	EEC 60 day average (ppb)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/ENEC)
Cotton	41	0.36	28.9	19.9	**0.70**	**55.27**
Dry Beans	41	0.36	28.2	21.8	**0.68**	**60.55**
Peanuts	41	0.36	17.4	11.8	**0.42**	**32.77**
Soybeans	41	0.36	22.3	13.2	**0.54**	**36.66**
Sugar Beets	41	0.36	53.0	36.8	**1.29**	**102.22**

Sheepshead minnow LC50 = 41 ppb; Sheepshead minnow ENEC = 0.36 ppb

Table 4.10. Acute and chronic RQs for estuarine/marine inverts using maximum application rates with 99% incorporation efficiency

Crop use	LC50 (ppb)	NOAEC (ppb)	EEC Initial/Peak (ppb)	EEC 21 day average (ppb)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/NOAEC)
Cotton	12	1	35.1	28.3	**2.92**	**28.30**
Dry Beans	12	1	30.6	26.4	**2.55**	**26.40**
Peanuts	12	1	21.1	15.6	**1.76**	**15.60**
Soybeans	12	1	26.7	20.1	**2.22**	**20.10**
Sugar Beets	12	1	78.0	59.7	**6.50**	**59.70**

Pink shrimp LC50 = 12 ppb; *Mysidopsis bahia* NOAEC = 1 ppb

*Even with only 1% of the compound available (99% incorporated), most aquatic organism acute and all chronic RQs calculated exceed LOCs for current uses.

4.2.2. Risk Conclusions for Aquatic Organisms

Parent aldicarb and its degradates are highly mobile and are known to move to ground water in sandy acidic soils. In poorly permeable soils, it will move with runoff. Following a rain event, aldicarb may reach aquatic environments as sheet and channel flow from areas of application, since aldicarb is moderately persistent in terrestrial environments and soluble in water. It is unlikely, though, that undissolved granules will reach surface water bodies as the granules themselves are not particularly mobile and in most cases buried below the surface. However, under the current label scenarios modeled for EECs, all aquatic organism, except aquatic plants, acute and chronic RQs exceeded all LOCs for all current uses.

5. IDENTIFICATION of CURRENT DATA GAPS

The fate and toxicity database for aldicarb is substantially complete. Data gaps, uncertainties and potential paths forward for the assessment of aldicarb are described below.

5.1. Fate

Environmental Chemistry Method for soil (850.6100): the Environmental Chemistry Method for soil is currently under review. The study will be required if the current submitted study along with the independent laboratory validation are deemed unacceptable.

5.2. Effects

Honeybee toxicity (non-guideline):
In keeping with the Agency's proposed new paradigm for determining potential adverse effects to insect pollinators from conventional pesticides (USEPA *et al.*, 2014), additional studies are being requested in addition to the already submitted adult acute contact study. The adult acute contact study using aldicarb resulted in an LD_{50} of 0.285 µg/bee and the compound was classified as highly toxic (MRID 00036935), there is considerable uncertainty regarding the potential effects of the compound on honeybee larval development and survival as well as potential for chronic effects. Because of its granular formulation, it is unlikely that there is a direct contact exposure scenario for honeybees. Other soil dwelling beneficial insects and invertebrates could be exposed to aldicarb and aldicarb residues through contact with the granules and/or with plants (via pollen and/or nectar) due to its systemic nature. However, because the chemical is systemic in nature exposure via pollen and/or nectar is possible; therefore, additional data on pollinators is needed to fully characterize the risk associated with aldicarb use to all developmental stages of honeybees, as sensitivity may vary according to life-stage and length of exposure (adult vs. larval and acute vs. chronic, respectively). Additional information is needed, but uncertainty associated with risks to honey bees need to be evaluated with more data to different life stages. Since this may be a systemic chemical that is transported throughout the plant, residues may be available to pollinators via pollen and/or nectar; therefore, residues of pollen and nectar of crops are a data need. Adult and larvae acute oral toxicity studies (following OECD 213) and larval and adult chronic toxicity studies (following OECD 237and non-guideline study) are necessary to evaluate the potential for aldicarb to adversely affect bees and other pollinators through other routes of exposure. Open literature data is needed to help better characterize some uncertainties regarding potential effects to bees and other non-target terrestrial invertebrates. In addition, higher tier effects toxicity tests (*i.e.,* semi-field and/or field studies – Tier II and Tier III, respectively) may be needed, based on the results of the larval and chronic adult toxicity studies. Higher tier studies are recommended if the ratio of the EEC and larval or adult bee acute LD50>**0.4** *or* the ratio of the EEC and the chronic NOAEC>**1**. Incident data and/or compelling open literature studies can also be used to support the need for higher tier studies. Should the screening level risk assessment identify that there are risk concerns to bees, mitigation measures may need to be considered or the registrant may need to conduct Tier II or Tier III effects studies (*e.g.* OECD Guideline 75 and/or 850.3040 guideline studies) that reduce uncertainty by characterizing aldicarb's effects at the whole-colony level.

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Appendix A. Submitted Environmental Fate & Ecological Effects Studies

Environmental Fate Studies

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098301 Aldicarb Eco Effects Bibliography
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71-2 Avian Dietary Toxicity

MRID	Citation Reference
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71-3 Mammal Acute

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71-5 Simulated or Actual Field Testing

MRID	Citation Reference
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72-1 Acute Toxicity to Freshwater Fish

MRID	Citation Reference
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76065	Knott, W.; Beliles, R.P. (1966) UC-21149: Acute Toxicity in Sunfish. (Unpublished study received Jul 26, 1966 under 1016-69; prepared by Woodard Research Corp., submitted by Union Carbide Corp., Arlington, Va.; CDL:231174-A)
76066	Woodard Research Corporation (1965) UC-21149: Safety Evaluation on Fish and Wildlife: (Bobwhite Quail and Rainbow Trout). (Unpublished study received Jul 26, 1966 under 1016-69; submitted by Union Carbide Corp., Arlington, Va.; CDL:231174-B)
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80706	Beliles, R.P.; Knott, W.; Wright, L. (1966) UC-21149: Safety Evaluation on Fish and Wildlife: (Bobwhite Quail and Rainbow Trout). (Unpublished study received Mar 2, 1967 under 7F0573; prepared by Woodard Research Corp., submitted by Union Carbide Corp., Charleston, W.Va.; CDL:090072-O)
80707	Knott, W.; Beliles, R.P. (1966) UC-21149: Acute Toxicity in Sun- fish. (Unpublished study received Mar 2, 1967 under 7F0573; prepared by Woodard Research Corp., submitted by Union Carbide Corp., Charleston, W.Va.; CDL:090072-P)
81883	Union Carbide Corporation (1965) Toxicity to Fish and Wildlife. (Compilation; unpublished study received May 10, 1965 under

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100296	Clarkson, V.A.; Hensley, W.H. (1968) Temik Insecticide: Toxicity of Temik, Temik Sulfoxide, and Temik Sulfone to Bluegill Sunfish: File No. 10493. (Unpublished study received Jan 25, 1978 under 1016-79; submitted by Union Carbide Corp., Arlington, Va.; CDL:096727-B)
102133	Schneider, C. (1979) The Acute Toxicity of Aldicarb Technical to the Rainbow Trout (Salmo gairdneri Richardson): UCES Proj. No. 11504-14-03. (Unpublished study received Dec 12, 1979 under 1016-78; submitted by Union Carbide Corp., Arlington, VA; CDL:099120-C)
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45592113	Odin-Feurtet, M. (1999) Aldicarb: Acute Toxicity (96-Hour) to Bluegill Sunfish (Lepomis macrochirus) under Static Conditions: Lab Project Number: SA 99331. Unpublished study prepared by Rhone-Poulenc Agro. 74 p.
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72-2 Acute Toxicity to Freshwater Invertebrates

MRID	Citation Reference
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72-3 Acute Toxicity to Estuarine/Marine Organisms

MRID	Citation Reference
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40228401	USEPA Gulbreeze Laboratory Study Reports- multiple species

72-4 Fish Early Life Stage/Aquatic Invertebrate Life Cycle Study

MRID	Citation Reference
66341	U.S. Environmental Protection Agency, Environmental Research Laboratory (1981) Acephate, Aldicarb, Carbophenothion, DEF, EPN, Ethoprop, Methyl Parathion, and Phorate: Their Acute and Chronic Toxicity, Bioconcentration Potential, and Persistence as Related to Marine Environments: EPA-600/4-81-023. (Unpublished study)
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72-7 Simulated or Actual Field Testing

MRID	Citation Reference
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142-3 Simulated or Actual Field Testing

MRID	Citation Reference
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Appendix A. Ecological Effects Data

Toxicity testing reported in this section does not represent all species of birds, mammals, or aquatic organisms. Only a few surrogate species for both freshwater fish and birds are used to represent all freshwater fish (2000+) and bird (680+) species in the United States. Mammalian acute studies are usually limited to Norway or New Zealand rat or the house mouse. Estuarine/marine testing is usually limited to a crustacean, a mollusk, and a fish. Also, neither reptiles nor amphibians are tested. The risk assessment assumes that avian and reptilian toxicities are similar. The same assumption is used for fish and amphibians in the aquatic environment. The following information was taken from previous assessments and updated if recent studies were submitted.

Toxicity to Terrestrial Animals[TC \l4 "a. Toxicity to Terrestrial Animals]

Birds, Acute and Subacute

The acute oral LD_{50} is 1.0 mg/kg-bw for aldicarb, and 33.5 mg/kg-bw for aldicarb sulfone. The most sensitive species tested for both aldicarb and aldicarb sulfone is the mallard duck. Aldicarb and aldicarb sulfone are categorized as very highly toxic and highly toxic to avian species on an acute oral basis, respectively (MRID 107398). Supplemental open literature suggests acute oral LD_{50s} of 0.75 mg/kg-bw aldicarb for passerine species (MRID 148695).

The most sensitive species tested on a subacute 5-d dietary basis for both aldicarb and aldicarb sulfone is the bobwhite quail. The 5-d LC_{50} is 71 ppm for aldicarb, and 5706 ppm for aldicarb sulfone (or sulfocarb). Aldicarb and aldicarb sulfone are categorized as very highly toxic and practically nontoxic to avian species, respectively (MRID 00102132 & 1096727).

Birds, Chronic

The avian reproduction studies submitted by the registrant were both classified as supplemental (MRIDs 48156905 & 48198801).

MRID 48156905 is a one-generation reproductive toxicity study involving dietary exposures of Northern bobwhite quail (*Colinus virginianus*) to aldicarb. Aldicarb was administered to the birds in the diet at nominal concentrations of 0 (vehicle control), 2, 10, and 50 mg ai/kg diet (corrected for purity). Mean-measured concentrations were <0.2 (<LOQ, control), 1.8, 8.3, and 43 mg ai/kg diet, respectively. This study is scientifically sound but classified supplemental because of small cage sizes and because the test was unable to detect up to 25% difference in treatment animal endpoints compared to controls. This study may not be used to fulfill the guideline requirement. Although none of the endpoints in the treated groups displayed statistically significant differences compared to controls, several of the endpoints had 10-25% difference in the two highest treatments. These endpoints include: number of eggs laid/pen, number of eggs set/pen, number of viable embryos/pen, number of live embryos/pen, number of hatchlings/pen, hatchling survival/pen. In addition, adult body weight gain was also decreased in these treatments. The reviewer concluded that these differences may be biologically significant. Therefore, the NOAEC of this study is set to the lowest test concentration (i.e., 1.8 mg a.i./kg-diet) and the LOAEC is 8.3 mg a.i./kg-diet.

MRID 48198801 is a one-generation reproductive toxicity study involving dietary exposures of mallard duck (*Anas platyrhynchos*) to aldicarb. Aldicarb was administered to the birds in the diet at nominal concentrations of 0 (vehicle control), 3, 15, and 75 mg ai/kg diet (corrected for purity). Mean-measured concentrations were <1.0 (<LOQ, control), 3, 15, and 72 mg ai/kg diet, respectively. There were slight, but statistically-significant ($p<0.05$) effects on several endpoints at the 15 mg ai/kg diet level; however, these effects were not observed at the next highest level (i.e., 72 mg a.i./kg diet). At the 15 mg a.i./kg diet level, there was a significant ($p=0.016$) increase in the number of eggs cracked, with an average of 0.25 eggs cracked per pen in the control versus 1.31 eggs per pen in the 15 mg ai/kg diet group. No other treatment level exhibited a higher incident of cracked eggs, but the 15 mg ai/kg diet level continued to exhibit reductions in the number of eggs set to eggs laid ($p=0.010$; 3.5% reduction from control), ratio of 14-day survivors to number hatched ($p=0.04$; 0.6% reduction), and hatchling weights ($p=0.004$; 5.8% reduction). No other treatment-related effects were observed at any concentration level for any adult, reproductive, or offspring parameter. Despite the observation of statistically significant effects at the 15 mg ai/kg level, the reviewer concluded that these effects were not related to the test substance because similar effects were not observed at the next highest treatment level (i.e., 72 mg a.i./kg diet), which was a factor of 5 greater than the level were effects were observed. This study is scientifically sound; however, it does not satisfy the guideline requirement for a mallard duck (*Anas platyrhynchos*) reproductive toxicity study. This study is classified supplemental because a LOAEC was not established in the study and the study report does not indicate the maximum field residue that would be expected based on application rates of aldicarb. Therefore, it is unknown if the highest level tested was an appropriate level to approximate the maximum expected field residues.

Mammals, Acute

Rat toxicity values obtained from the Agency's Health Effects Division (HED) substitute for wild mammal testing. Aldicarb is categorized as very highly toxic to small mammals on an acute oral basis with a rat LD_{50} of 0.9 mg/kg-bw (MRID 00057333).

Mammals, Chronic

In a 2-generation reproduction study reviewed by HED (MRID 42148401), rats were exposed to aldicarb in their diet at concentrations of 0, 2, 5, 10, and 20 ppm. Exposure consistently led to decreased dam body weight gain (parental LOAEL = 0.7 - 0.9 mg/kg-bw; NOAEL = 0.4 mg/kg-bw). Aldicarb treatment also caused lower survivability and pup weights in offspring of all litters (reproductive LOAEL = 1.4 - 1.7 mg/kg-bw; NOAEL = 0.7 - 0.9 mg/kg-bw). These toxicity values are similar to the acute oral LD_{50} mammalian values and suggest that mammals that survive acute aldicarb exposure may suffer adverse reproductive effects from chronic exposure.

Beneficial Insects

A honey bee acute contact study using the TGAI is not required for aldicarb due to its granular formulation. However, aldicarb is categorized highly toxic to bees on an acute contact basis with an LD_{50} of 0.285 ug/bee (MRID 00036935). It is recognized that potential honey bee exposure may occur due to the systemic nature of aldicarb. Because of its granular formulation, it is

unlikely that there is a direct contact exposure scenario for honey bees; however, these and other beneficial insects could be exposed to aldicarb and aldicarb residues through contact with plants and soil.

Earthworms

Soil-dwelling invertebrates, such as earthworms, can play important roles in maintaining soil fertility and facilitating organic matter degradation, as well as an important food source for birds and mammals. A study by Mosleh et al (2003) demonstrated an earthworm (*Aporrectodea caliginosa*) 28-day LC_{50} of 0.68 ppm.

***Toxicity to Terrestrial Plants*[TC \l4 "b. Toxicity to Terrestrial Plants]**

Terrestrial plant testing is required for pesticides other than herbicides if data from the literature indicate that a pesticide is phytotoxic. A tier I seedling emergence study (MRID 4704401) is classified supplemental and cannot be used to fulfill the guideline requirement for 850.4100. A Tier II seedling emergence study was submitted for ryegrass and tomato (MRID 49477401). No effects to Ryegrass of Tomato resulted in the Tier II study using granular TEMIK 15G.

Summary of review of MRID 47904401

The effect of Temik 15 G (AI: Aldicarb) on the seedling emergence of monocot (corn, *Zea mays*; oat, *Avena sativa*; onion, *Allium cepa*; and ryegrass, *Lolium perenne*) and dicot (cucumber, *Cucumis sativus*; oilseed rape, *Brassica napus*; sugarbeet, *Beta vulgaris*; soybean, *Glycine max*; sunflower, *Helianthus annuus*; and tomato, *Lycopersicon esculentum*) crops was studied at nominal concentrations of 0 (negative control) and 75 kg product/ha, which is equivalent to 11.5 kg ai/ha (10.3 lb ai/A). The growth medium used in the seedling emergence test was a mixture of natural soil (silt loam) and washed sand; pH 7.24, organic carbon 0.63%. On day 21, the surviving plants per pot were recorded and cut at soil level for measuring the plant height and dry weight.

The most sensitive monocot species was ryegrass, with a 12 and 44% difference in shoot length and weight, respectively, compared to the control. The most sensitive dicot species was tomato, with a 28 and 25% difference in shoot length and weight, respectively, compared to the control. Phytotoxic effects, including stunting and necrosis, were observed in ryegrass and tomatoes. Based on the observance of >25% effects in ryegrass and tomato, a tier II study consistent with OCSPP guideline 850.4225 and using these two species is necessary to fulfill the guideline requirement for 850.4100. The Tier I studies with ryegrass and tomato are considered supplemental. The data from the Tier I studies with corn, oat, onion, cucumber, oilseed rape, soybean, sugarbeet and sunflower are all considered acceptable. Overall, this toxicity study is classified supplemental and does not satisfy the guideline requirement for a seedling emergence toxicity study because >25% effects were observed in two species (i.e., ryegrass and tomato) and tier II studies have not been submitted for those species.

Toxicity to Freshwater Animals[TC \l4 "a. Toxicity to Freshwater Animals"]

Freshwater Fish, Acute

Aldicarb

Since the 96-h LC_{50} values ranged from 52 to 110 ppb ai, aldicarb is categorized as very highly toxic to highly toxic to freshwater fish on an acute basis. The most sensitive of these results was the 52 ppb ai for the bluegill sunfish (Mayer and Ellersieck 1986) conducted under static conditions. A supplemental acute toxicity test conducted under static conditions reported a 96-h LC_{50} for aldicarb of 110 ppb ai for juvenile bluegill sunfish. Because of the static conditions, it is likely this value reflects contribution of parent aldicarb and its degradates. The bluegill sunfish 96-h LC_{50} of 52 ppb ai was chosen to calculate acute risk quotients from exposure to aldicarb because it is the most sensitive endpoint of the 96-h LC_{50} values. There was an acute value for fathead minnow exposed to aldicarb found in the public literature but it was only for a 48 hour study, therefore it is likely an underestimate of aldicarb toxicity to this species at 96 hours and is therefore classified as supplemental information.

Acute Toxicity Endpoints for Freshwater Fish[TC "Table 11. Acute Toxicity Endpoints for Freshwater Fish" \f E \l "1"]

Species	Endpoint (ppb ai)	MRID/Reference
Aldicarb		
Bluegill sunfish	96-h LC_{50} = 52 ppb ai	MRID 40098001and MRID3503 (Mayer and Ellersieck 1986)
Rainbow trout	96-h LC_{50} = 560 ppb ai	MRID 40098001and MRID 3503 (Mayer and Ellersieck
Fathead minnow	48-hr LC_{50} = 8,860 ppb ai	Moore. *et al.* 1998 (Supplemental information as this is only a 48-h study)
Aldicarb sulfoxide		
Rainbow trout	96-h LC_{50} = 7,140 ppb ai	MRID 45592115
Aldicarb sulfone		
Rainbow trout	96-h LC_{50} = 42,000 ppb ai	Acc# 096727 (Anonymous 1976)
Rainbow trout	96-h LC_{50} > 106,000 ppb ai	MRID 45592117

Aldicarb sulfoxide

A flow through acute toxicity test using the degradate aldicarb sulfoxide was conducted on rainbow trout. A 96-h LC_{50} of 7,140 ppb was reported which is classified as moderately toxic (MRID 45592115).

Aldicarb sulfone

An acute toxicity test conducted on rainbow trout using the degradate aldicarb sulfone had a 96-h LC_{50} of 42,000 ppb ai. This is characterized as slightly toxic [Acc# 096727 (Anonymous 1976)]. A flow through acute toxicity test using aldicarb sulfone had a 96-h LC_{50} greater than 106,000 ppb ai for rainbow trout, which is characterized as practically non toxic (MRID 45592117).

Based on the acute toxicity studies for freshwater fish, the relative toxicity relationship is: aldicarb>aldicarb sulfoxide> aldicarb sulfone.

Freshwater Fish, Chronic

Aldicarb

A freshwater fish early life-stage test using aldicarb (99% ai) has been conducted with the fathead minnow. The NOAEC was 78 ppb ai and the LOAEC was 156 ppb ai. The most sensitive endpoint was the survival of larvae-juveniles after 30-days exposure (MRID 44598601 also known as BOWOAL07/4 (Q.H. Pickering and W.T. Gilliam 1982)). However, according to the acute freshwater fish data the bluegill sunfish was the most sensitive freshwater fish tested with a 96-h LC_{50} of 52 ppb ai. This 96-h LC_{50} of 52 ppb ai is lower than the NOAEC of 78 ppb ai for the fathead minnow, indicating that the bluegill is much more sensitive to aldicarb than the fathead minnow. Therefore, a screening level chronic RQ for fish cannot be calculated using the fathead minnow chronic NOAEC directly. However since both a supplemental acute (48-h LC_{50}= 8,860 ppb ai; Moore. *et al.* 1998) and acceptable chronic (NOAEC = 78 ppb ai) aldicarb value exist for fathead minnow, an acute-to-chronic ratio (ACR) can be calculated for this species and then used to determine an estimated NOAEC for the bluegill sunfish.

The ACR for the fathead minnow of 114 is calculated by dividing the fathead minnow 48-hr EC_{50} of 8,860 ppb ai by the fathead chronic NOAEC of 78 ppb ai. The 96-h LC_{50} of 52 ppb ai for the bluegill sunfish is then divided by the ACR of 114 which results in an estimate of the chronic NOAEC for the bluegill sunfish of 0.46 ppb ai. A 48-h LC_{50} value was used to calculate the ACR rather than a 96-h LC_{50} because none was available, this potentially over estimates the ACR for fathead minnow. Additionally, a robust estimate of an ACR (i.e., geometric mean of ACRs for at least three fish species with at least one coldwater and one warmwater species) for aldicarb could not be calculated because only one fish species, the fathead minnow, had both acute and chronic endpoints available for determination of an ACR. While a more robust estimate of the ACR is desirable, the use of the fathead minnow ACR is a reasonable estimate but may be either a slight over or underestimate of ACR for fish.

Chronic Toxicity Endpoints for Freshwater Fish[TC "Table 12. Chronic Toxicity Endpoints for Freshwater Fish" \f E \l "1"]

Species	Endpoint	MRID/Reference
Aldicarb		
Fathead minnow	fish early life stage NOAEC = 78 ppb ai	MRID 44598601 also known as BOWOAL07/4 (Q.H. Pickering and W.T. Gilliam 1982)

Bluegill sunfish	Estimated NOAEC = 0.46 ppb ai	96-h LC_{50} for bluegill sunfish (52 ppb ai) divided by ACR (fathead minnow 48-h EC_{50} of 8860 ppb ai divided by NOAEC of 78 ppb ai)

Freshwater Invertebrates, Acute

Aldicarb

A *Daphnia magna* core study determined the 48-h EC_{50} to be 410 ppb ai (Acc #096683, also known as BOWOAL08 and MRID 107395 (Vilkas 1977), categorizing aldicarb as highly toxic to aquatic freshwater invertebrates on an acute basis. Because this test was conducted under static rather than flow-through conditions, it is likely that this value reflects the contributions of a mixture of parent aldicarb and various degradates. A supplemental study from the literature reported the 48-h LC_{50} of aldicarb to *Daphnia magna, Aedes aegypti, Atermia sp.,* and *Aedes taeniorhynchus* as 75, 290, 5460, and 150 ppb ai respectively, in 48 hour static tests (Song *et al.*, 1997). A supplemental study from open literature also concluded that aldicarb was very-highly toxic to *Daphnia magna* with a reported 48-h EC_{50} of 583 ppb (Moore. *et al.* 1998). This same study reported a 48-h EC_{50} of 3990 ppb for *Hyalella azteca* (categorized as moderately toxic) and a reported 48-h EC_{50} of 20 ppb for *Chironomus tentans.* A supplemental study obtained from open literature (Foran *et al.* 1985) determined the 48-h EC_{50} of juvenile *Daphnia laevis* to be 65 ppb and 51 ppb for adult *Daphnia laevis* categorizing aldicarb as very highly toxic.

Because Moore *et al.* (1998) is classified as a supplemental study of high quality, the 48-h *Chironomus tentans* EC_{50} value of 20 ppb will be used in the risk characterization.

Aldicarb sulfoxide

Foran *et al.* 1985 also found that aldicarb sulfoxide is also very highly toxic to *Daphnia laevis*, with a 48-h EC_{50} of 57 ppb for juveniles and 43 ppb for adults. Thus, aldicarb sulfoxide toxicity to freshwater invertebrates appears to be similar in toxicity to aldicarb. A supplemental static acute toxicity test was performed using the degradate aldicarb sulfoxide with the test species *Daphnia magna*. The 48-h EC_{50} was 696 ppb, which is classified as highly toxic to daphnids (MRID 45592114).

Aldicarb sulfone

Based on a core study, the 48-h EC_{50} for aldicarb sulfone is 280 ppb for *Daphnia magna* which is categorized as highly toxic to freshwater invertebrates on an acute basis [Acc# 096727 (Anonymous 1976)]. Foran *et al.* (1985) also found that the toxicity of aldicarb sulfone to daphnids is in the highly toxic category (juvenile 48-h EC_{50}=556 ppb and adult 48-h EC_{50}=369 ppb).

Based on the acute toxicity studies for freshwater invertebrates, the relative toxicity relationship is: aldicarb [EMBED Equation.3]aldicarb sulfoxide > aldicarb sulfone.

Acute Toxicity Endpoints for Freshwater Invertebrates[TC "Table 13. Acute Toxicity

Endpoints for Freshwater Invertebrates" \f E \l "1"]

Species	Endpoint	MRID/Reference
Aldicarb		
Daphnia magna	48-h EC_{50} = 410 ppb	Acc #096683, also known as BOWOAL08 and MRID 107395 (Vilkas 1977),
Daphnia magna	48-hr LC_{50} = 75 ppb	Song *et al.*, 1997
Aedes aegypti	48-hr LC_{50} = 290 ppb	Song *et al.*, 1997
Atermia sp.	48-hr LC_{50} = 5460 ppb	Song *et al.*, 1997
Aedes taeniorhynchus	48-hr LC_{50} = 150 ppb	Song *et al.*, 1997
Daphnia magna	48-hr EC_{50} = 583 ppb	Moore. *et al.* 1998
Hyalella azteca	48-hour EC_{50} = 3990 ppb	Moore. *et al.* 1998
Chironomus tentans	48-hour EC_{50} = 20 ppb	Moore. *et al.* 1998
Daphnia laevis (juvenile)	48 hr EC_{50} =65 ppb	Foran *et al.* 1985
Daphnia laevis (adult)	48 hr EC_{50} = 51 ppb	Foran *et al.* 1985
Aldicarb sulfoxide		
Daphnia magna	48-h EC_{50} = 696 ppb	MRID 45592114
Daphnia laevis (adult)	48 hr EC_{50} = 43 ppb	Foran *et al.* 1985
Daphnia laevis (juvenile)	48 hr EC_{50} =57 ppb	Foran *et al.* 1985
Aldicarb sulfone		
Daphnia magna	48-h EC_{50} = 280 ppb	Acc# 096727 (Anonymous 1976)
Daphnia laevis (adult)	48-h EC_{50}=369 ppb	Foran *et al.* (1985)
Daphnia laevis (juvenile)	48-h EC_{50}=556 ppb	Foran *et al.* (1985)
Qualitative Studies		
Midge, *Chironomus riparius*	Symptoms of intoxication	Kallander et al. 1997
Midge, *Chironomus riparius*	24-hr LC_{50} (water only) = 9.9 ppb 24-hr LC_{50} (spiked water) = 10.0 ppb, 24-hr LC_{50} (spiked sediment) = 26.7 ppb	Lydy et al. 1990
Gammarus italicus Goedm.	96-hr LC_{50} = 420 ppb	Pantani et al. 1997

Species	Endpoint	MRID/Reference
Echinogammarus tibaldii Pink.	96-hr LC_{50} = 220 ppb	Pantani et al. 1997
Midge *Chironomus riparius*	24 hr EC_{50} value = 23 ppb	Sturm and Hansen 1999
Daphnid *Daphnia magna*	24 hr EC_{50} value = 227.6 ppb	Sturm and Hansen 1999
Aedes *taeniorhynchus*	48-hr LC_{50} = 150 ppb (hyperosmotic condition) 72-hr LC50=200 ppb (isosmotic conditions)	Song and Brown 1998
Artemia sp.	48-hr LC_{50} = 5460 ppb (hyperosmotic) 72-hr LC50=17250 ppb (isosmotic conditions)	Song and Brown 1998
Pond snail *Lymnaea acuminata*	48-hr LC_{50} = 20000 ppb	Singh and Agarwal 1981
Apple snail *Pila globosa* Swainson	48-hour LC_{50} value could not be determined	Singh and Agarwal 1981
Midge *Chironomus riparius*	None	Fisher et al. 1993
Midge *Chironomus riparius*	24-hour LC_{50} values ranged from 17-28 ppb at pH 4-8	Suorsa and Fisher 1986
Aldicarb sulfoxide		
Daphnia magna	EC_{50} = 696 ppb	MRID 45592114
Daphnia laevis (adult)	48 hr EC_{50} = 43 ppb	Foran *et al.* 1985
Daphnia laevis (juvenile)	48 hr EC_{50} =57 ppb	Foran *et al.* 1985
Aldicarb sulfone		
Daphnia magna	EC_{50} = 280 ppb	Acc# 096727 (Anonymous 1976)
Daphnia laevis (adult)	EC_{50}=369 ppb	Foran *et al.* (1985)
Daphnia laevis (juvenile)	EC_{50}=556 ppb	Foran *et al.* (1985)

Freshwater Invertebrate Qualitative Studies

Using the database ECOTOX to identify additional data from the open literature, several supplemental studies were identified that can be used qualitatively to discuss the effects of aldicarb on freshwater invertebrates. These studies were not appropriate for quantitative use in calculation of risk quotients.

A one day test identified aldicarb as very highly toxic to the midge and daphnid on an acute toxicity basis under static conditions. The 24-h EC_{50} value was reported to be 23 ppb a.i. for the midge and 227.6 ppb a.i. for the daphnid (Sturm and Hansen 1999).

Several studies examined the effects of aldicarb to freshwater invertebrates and the effects of pulse dosing, pH, and different modes of exposure. In a pulsed exposure test, Kallander *et al.* (1996) studied midges *(Chironomus riparus)* exposed to aldicarb under static conditions. Midges exposed to aldicarb for two, pulsed 1-hour periods with a recovery period in clean water for 6 or more hours showed significantly fewer symptoms of intoxication than those exposed continuously for 2 hours. This indicates that continuous exposure to aldicarb from runoff events with no recovery time would exacerbate the symptoms of intoxication for freshwater invertebrates.

The 24 hour acute toxicity of aldicarb to *Chironomus riparus* was studied under static conditions at pH 4, 6, and 8 (Suorsa and Fisher 1986). The 24-h LC_{50} values ranged from 17-28 ppb for aldicarb at pH 4-8. Toxicity of aldicarb to midges did not differ significantly as a function of pH.

A 24 hour static study by Lydy *et al* (1990) evaluated three modes of exposure of aldicarb to *Chironomus riparius*: treated water only with no sediment (water only); treated water with untreated sediment (spiked water); and treated sediment with untreated water (spiked sediment). The reported 24-h LC_{50} for the water only, spiked water, and spiked sediment treatments were 9.9, 10.0 and 26.7 ppb respectively, which classifies aldicarb as very highly toxic to *C. riparius* on an acute toxicity basis for all three routes of exposure. In addition, these tests indicate that the water exposure pathways produce more sensitive endpoints than sediment exposure. This affirms the use of acute aquatic toxicity tests using aldicarb for freshwater invertebrates to be the most sensitive route of exposure.

Fisher et al. 1993 studied the toxicity of aldicarb to the midge with and without sediment. Five molecular descriptors (molecular volume, Henry's law constant, n-octanol/water partition coefficient, molecular connectivity, and linear solvation energy) were used in regression analysis as potential predictors of pesticide activity. Quantitative structure activity relationships indicate sediment sorption plays a large role in the ultimate toxicity of aldicarb to the midge.

Several studies were identified that deal with species not normally tested in registrant submitted studies. These studies classified aldicarb in a range of slightly toxic to highly toxic. The 96-hr acute toxicity of aldicarb to *Gammarus italicus* Goedm and *Echinogammarus tibaldii* Pink was studied under static conditions (Pantani *et al.* 1997). The 96-h LC_{50} value was determined to be 420 ppb a.i. and 220 ppb a.i., respectively, which categorizes aldicarb as highly toxic on an acute toxicity basis.

The 240-hr acute toxicity of aldicarb to the pond snail *Lymnaea acuminata* and the apple snail *Pila globosa* Swainson was studied under static conditions (Singh and Agarwal 1981). Paralysis was observed in the test organisms within 24 hours of exposure even though the animals remained alive for varying lengths of time; no mortality was observed in the control group. The 48-h LC_{50} value was 20000 ppb a.i., which categorizes aldicarb as slightly toxic to *L. acuminata* on an acute toxicity basis. The 48-h LC_{50} value could not be determined for the apple snail within the range of doses tested. The LC_{50} values from 72 hours to 240 hours ranged from

210000-78000 ppb, which categorizes aldicarb as practically non-toxic to slightly toxic to *P. globosa* on an acute to subchronic toxicity basis.

The 48-h hyperosmotic and 72-hour isosmotic acute toxicities of aldicarb to the mosquito *Aedes taeniorhynchus* and brine shrimp *Artemia* sp. were studied under static conditions (Song and Brown 1997). Mosquito and nauplii larvae were exposed to the test material at two different salinities, hyperosmotic and isosmotic. Under hyperosmotic conditions, the reported *Aedes* 48-hour LC_{50} was 150 ppb a.i and the *Artemia* 48-hour LC_{50} was 5460 ppb a.i. Aldicarb is thus, classified as highly toxic to *Aedes* and moderately toxic to *Artemia* sp. Under isosmotic conditions, the reported 72-hour LC50 was 200 ppb a.i. for *Aedes* (highly toxic) and the 72-hour LC50 was 17250 ppb a.i. for *Artemia (*slightly toxic).

Freshwater Invertebrate, Chronic

Aldicarb

The chronic risk to freshwater invertebrates is based on the estuarine/marine chronic study using *Mysidopsis bahia*. The reason for using this endpoint is based on the memorandum dated December 14, 1993, from A. Maciorowski, EFED to P. Poli, SRRD (D196663): "EEB has previously received and reviewed a valid Mysid shrimp chronic toxicity study that resulted in a calculated MATC of 1-1.5 ppb. Since the acute data indicates that the Mysid shrimp is more sensitive to aldicarb than *Daphnia magna* (Mysid shrimp LC_{50} = 16 ppb, *Daphnia magna* LC_{50} = 410.7 ppb) and EEB does have valid Mysid shrimp chronic toxicity data, EEB is willing to waive the requirement for the Guideline 72-4(b) Freshwater Invertebrate Life Cycle Study. However, as a result all aquatic risk assessments utilizing invertebrate chronic toxicity data will be based on the Mysid shrimp data." The mysid shrimp NOAEC is 1.0 ppb.

A supplemental chronic toxicity study was submitted that evaluated the effect of aldicarb (99.9% a.i.) on *Daphnia magna*. An EC_{50} of 90 ppb, NOAEC of 20 ppb, and LOAEC of 60 ppb were reported for mortality and immobilization. An EC_{50} with a range of 190 to 570 ppb, NOAEC of 190 ppb and LOAEC greater than 190 ppb were reported for reproductive effects. The most sensitive endpoint was reproductive effects (MRID 45592112). This study is classified as supplemental and is not upgradeable to core due to the study's deviations.

Chronic Toxicity Endpoints for Freshwater Invertebrates[TC "Table 14. Chronic Toxicity Endpoints for Freshwater Invertebrates" \f E \l "1"]

Species	Endpoint	MRID/Reference
Aldicarb		
Daphnia magna	NOAEC = 20 ppb	MRID 45592112

***Toxicity to Estuarine and Marine Animals*[TC \l4 "b. Toxicity to Estuarine and Marine Animals]**

Estuarine and Marine Fish, Acute

Aldicarb

Based on results from the preferred test species, sheepshead minnow, 96-h LC_{50} values range from 41 to 170 ppb. Therefore, aldicarb is categorized very highly to highly toxic to estuarine/marine fish on an acute basis. The most sensitive estuarine/marine fish species tested was the sheepshead minnow with a 96-h LC_{50} of 41 ppb [MRID 40228401 (U.S. EPA 1986)]. A supplemental study obtained from open literature (Landau and Tucker 1984) found a similar magnitude value for a snook *(Centropomus undecimalis)* embryo/larva bioassays with a 36-hr LC_{50} of 40 ppb. After 96-hr of exposure the snook may have a lower LC_{50}; therefore, the snook may be more sensitive than the sheepshead minnow.

Acute Toxicity Endpoints for Estuarine and Marine Fish[TC "Table 15. Acute Toxicity Endpoints for Estuarine and Marine Fish" \f E \l "1"]

Species	Endpoint	MRID/Reference
Aldicarb		
Sheepshead minnow	96-h LC_{50} = 41 ppb	MRID 40228401 (U.S. EPA 1986)
Snook *(Centropomus undecimalis)*	36-h LC_{50} = 40 ppb	Landau and Tucker 1984
Sheepshead minnow (*Cyprinodin variegates*)	96-h LC_{50} = 170 ppb	MRID 40228401 (U.S. EPA 1986)

Estuarine and Marine Fish, Chronic

Aldicarb

A chronic estuarine/marine fish early life-stage test using aldicarb (99% ai) has been conducted with the sheepshead minnow. The NOAEC was 50 ppb and the LOAEC was 88 ppb. The most sensitive endpoint was growth based on the mean standard length [MRID 00066341 (U.S. EPA 1981b)]. The lowest chronic endpoint value available for sheepshead minnow is higher than the lowest acute endpoint value for sheepshead minnow. Therefore, it not appropriate to screen for chronic risks to estuarine/marine fish with this value. However, since there is an ACR of 114 available for fish (freshwater fathead minnow ACR, see the Freshwater Fish, Chronic Aldicarb section above) this value was used to estimate a chronic NOAEC using the acute 96-h LC_{50} for sheepshead minnow from MRID 40228401.

The estimated chronic NOAEC for the sheepshead minnow is 0.36 ppb and is calculated by dividing the 96-h LC_{50} of 41 ppb for the sheepshead minnow by the ACR for fathead minnow of 114. As discussed in the Freshwater Fish, Chronic Aldicarb section above a 48-h LC_{50} value was

used to calculate the ACR rather than a 96-h LC_{50} because none was available, this potentially over estimates the ACR for fathead minnow. Additionally, a robust estimate of an ACR (i.e., geometric mean of ACRs for at least three fish species with at least one coldwater, one warmwater and one saltwater species) for aldicarb could not be calculated because only one fish species, the fathead minnow, had both acute and chronic acceptable endpoints available for determination of an ACR. While a more robust estimate of the ACR is desirable, the use of the fathead minnow ACR is a reasonable estimate but may be either a slight over or underestimate of ACR for fish.

Chronic Toxicity Endpoints for Estuarine and Marine Fish[TC "Table 16. Chronic Toxicity Endpoints for Estuarine and Marine Fish" \f E \l "1"]

Species	Endpoint (NOAEC)	MRID/Reference
Aldicarb		
Sheepshead minnow	Early life stage NOAEC = 50 ppb	MRID 00066341 (U.S. EPA 1981b)
Sheepshead minnow	Estimated NOAEC = 0.36 ppb	96-h LC_{50} for sheepshead minnow (41 ppb ai) divided by ACR (fathead minnow 48-h EC_{50} of 8860 ppb ai divided by NOAEC of 78 ppb ai)

Estuarine and Marine Invertebrates, Acute

Aldicarb

Based on results from the preferred test species, pink shrimp and Eastern oyster, following test guidelines, the toxicity values fall in the range of 12 to 8800 ppb. Therefore, aldicarb is categorized as very highly to moderately toxic to estuarine/marine invertebrates on an acute basis. The 48-h EC_{50} for the Eastern oyster is reported as 8800 ppb. Therefore, the most sensitive estuarine/marine invertebrate tested was the pink shrimp, with a 96-h LC_{50} of 12 ppb [MRID 40228401 (U.S. EPA 1986)].

Acute Toxicity Endpoints for Estuarine and Marine Invertebrates[TC "Table 17. Acute Toxicity Endpoints for Estuarine and Marine Invertebrates" \f E \l "1"]

Species	Endpoint	MRID/Reference
Aldicarb		
Eastern oyster	48-h EC_{50} = 8800 ppb	MRID 40228401 (U.S. EPA 1986)
Pink shrimp	96-h LC_{50} = 12 ppb	MRID 40228401 (U.S. EPA 1986)

Estuarine and Marine Invertebrate, Chronic

Aldicarb

A chronic estuarine/marine invertebrate full life-cycle test using aldicarb (99% ai) has been conducted with the mysid shrimp. The NOAEC was 1 ppb and the LOAEC was 1.5 ppb. The most sensitive endpoint was average number of offspring [MRID 00066341(U.S. EPA 1981b)].

Chronic Toxicity Endpoints for Estuarine and Marine Invertebrates[TC "Table 18. Chronic Toxicity Endpoints for Estuarine and Marine Invertebrates" \f E \l "1"]

Species	Endpoint	MRID/Reference
Aldicarb		
Mysid shrimp	Full life cycle NOAEC = 1 ppb	MRID 00066341

***Toxicity to Aquatic Plants*[TC \l4 "c. Toxicity to Aquatic Plants]**

Aldicarb

According to CFR 40 Part 158.540, aquatic plant testing is generally not required for non-herbicides unless there is evidence of potential phytotoxicity at use rates from other lines of evidence. At this time, EFED has one study conducted on the marine diatom, *Skeletonema costatum* (MRID 40228401) and a study on Duckweed (MRID 47904402). The EC_{50} is >50 ppm for the diatom and >88.7 ppm for duckweed.

Toxicity Endpoints for Aquatic Plants[TC "Table 19. Toxicity Endpoints for Aquatic Plants" \f E \l "1"]

Species	Endpoint	MRID/Reference
Aldicarb		
Marine diatom, *Skeletonema costatum*	EC_{50} > 50 ppm	MRID 40228401
Duckweed, *Lemna gibba*	EC50 >88.7 ppm	MRID 47904402

Summary of review of MRID 47904402

In a 7 day acute toxicity study, Duckweed (*Lemna gibba;* freshwater floating aquatic vascular plants) were exposed to Aldicarb Technical at nominal concentrations of 0 (negative control), 2.56, 6.40, 16.0, 40.0, and 100 mg ai/L under static renewal conditions. Measured concentrations were <0.20 (<LOQ, control), 2.17, 5.50, 14.3, 35.9, and 88.7 mg ai/L.

The % growth inhibition of frond number in the treatment groups as compared to the control ranged from 4 to 41%. For biomass based on frond number, inhibitions ranged from 3 to 38%. For dry weight, inhibitions ranged from 5 to 46%. There were no compound related phytotoxic effects.

The NOAEC for this study was 5.50 mg a.i./L, based on effects to frond number, biomass and dry weight at 14.3 mg a.i./L. For all endpoints that were included in this study (*i.e.,* frond number, dry weight and growth rate), <50% effects were observed, resulting in an EC50 value >88.7 mg ai/L (*i.e.,* the highest test concentration). Since a dose-response relationship was observed in this test and the highest test concentrations resulted in almost 50% effects, extrapolated EC50 values were calculated by the reviewer. The lowest extrapolated EC50 was 110 (95% confidence interval: 90-130; slope = 1.74+/- 0.251) based on effects to dry weight. Although an EC50 value was not bound by the concentrations used in this test and the highest test concentration was not 100 mg a.i./L, the extrapolated EC50 value for dry weight and the available NOAECs are sufficient to establish endpoints from this study. This toxicity study is considered scientifically sound and classified acceptable. This study may be used to satisfy the guideline requirement for an aquatic plant toxicity study using *Lemna* sp.

Appendix B. Aquatic Model File

[EMBED Package][EMBED Package]

Appendix C. Domestic Animal and Aggregate Incident Summary for Aldicarb

Domestic Animal Incidents Associated with Aldicarb Products as Reported in the Incident Data System (IDS)

Incident Package Report	Incident Date	Location	Country	Product Name	PC Code	Package Description
008922 - 00001	5/5/1998	BASTROP, LA	US	ALDICARB	098301	Rhone-Poulenc: 5 D-A reports: 10/1- 12/31/98: a/d/e) Dogs and cats given food baited with aldicarb. b/c) Dogs poisoned but no bait found.
008922 - 00002	6/8/1998	WINSER, LA	US	ALDICARB	098301	Rhone-Poulenc: 5 D-A reports: 10/1- 12/31/98: a/d/e) Dogs and cats given food baited with aldicarb. b/c) Dogs poisoned but no bait found.
008922 - 00003	9/12/1998	WINSER, LA	US	ALDICARB	098301	Rhone-Poulenc: 5 D-A reports: 10/1- 12/31/98: a/d/e) Dogs and cats given food baited with aldicarb. b/c) Dogs poisoned but no bait found.
008922 - 00004	6/1/1998	TUTWILER, MS	US	ALDICARB	098301	Rhone-Poulenc: 5 D-A reports: 10/1- 12/31/98: a/d/e) Dogs and cats given food baited with aldicarb. b/c) Dogs poisoned but no bait found.
008922 - 00005	11/9/1998	ELLISVILLE, MS	US	ALDICARB	098301	Rhone-Poulenc: 5 D-A reports: 10/1- 12/31/98: a/d/e) Dogs and cats given food baited with aldicarb. b/c) Dogs poisoned but no bait found.
009194 - 00001	1/1/1999	HARPER'S FERRY, WV	US	TEMIK BRAND 15G ALDICARB PESTICIDE	098301	Updates aggreg. I008694: D-A: dog poisoned by Aldicarb, Harper's Ferry, WV. Also 3 dogs, falcon, hawk died (w/ no confirmed link to chem.) Feud.
009286 - 00001	1/1/1999	ROGERSVILLE, AL	US	TEMIK	098301	Horses sick next to cotton field. Many chemicals applied to field. Horse had neurological symptoms: labored breathing, twitching... Owner sick too.
010439 - 00002	6/1/2000	MS	US	TEMIK	098301	Aventis: 2 Temik poisonings: misuse: a) coyote & opossum died, b) hunting dog, buzzard, raccoon died. Lawsuits: Aventis encourages prosecution
011127 - 00001	1/25/2001	BOWMAN, SC	US	TEMIK BRAND 15G ALDICARB PESTICIDE	098301	Aventis: intentional poisoning of broiler chickens, Bowman, SC. Some chickens processed. FDA issued recall. Misuse. See I011201 for residue.

Incident Package Report	Incident Date	Location	Country	Product Name	PC Code	Package Description
011146 - 00001	2/13/2001	SUMTER, SC	US	ALDICARB	098301	Gold Kist Inc. recalls 421,000 lbs. of chicken products for possible contamination with Aldicarb malicious intent by unknown person. Update I011127
011201 - 00001	2/6/2001	BOWMAN, SC	US	TEMIK BRAND 15G ALDICARB PESTICIDE	098301	Aventis: Updates I011127: Lab analysis of feed from 1 of 4 chicken houses showed aldicarb. Rendered fat from recall - no aldicarb
013932 - 00001	1/1/2003	CA	US	ALDICARB	098301	2 dogs became ill near wool grower area. Aldicarb in lethal amount found in regurgitated hot dog. Suspect poison was meant for coyotes nearby.
014563 - 00001	11/1/2003	CHINO VALLEY, AZ	US	TEMIK	098301	2 dogs killed from misuse of Temik, man arrested, inspection of ranch pending. Chino Valley, Yavapai Co., AZ. Temik found in food bowl & vomit.
016540 - 00001	1/1/2005	CO	US	TEMIK	098301	Dog exposed to spilled container of Temik in abandoned barn. Dead cat was found near the spilled Temik. Vet confirmed Temik in cat
016940 - 00014	3/2/2005	DOS PALOS, CA	US	ALDICARB	098301	46 EPA Region 9 cases: 4 H-A, 1 D-A, 1 W-A, 10 P-A, 4 H-B, 19 H-C, 1 H-D, 2 H, 5 E. 1 suicide, 1 attempted suicide, 3 accidental deaths. Spill
017085 - 00001	1/3/2006	ARMUCHEC, GA	US	ALDICARB	098301	1 Georgia incident. 2 opossums & 1 dog dead after ingesting Aldicarb. Another dog severely ill. Necropsies on opossums: Carbamate toxicosis.
017086 - 00001	1/3/2006	ARMUCHEC, GA	US	ALDICARB (SUSPECT TEMIK)	098301	Update to I017085-001. Aldicarb poisoning of 2 opossums & 1 dog. Suspect aldicarb placed in deer carcass for bait to kill coyotes.
017141 - 00001	1/3/2006	ARMUCHEC, GA	US	ALDICARB	098301	Update to I017085 includes notes from phone conv. with Ranger Grant Matherly. 1 dog & 2 opossums dead of Carbamate toxicosis (Aldicarb). Georgia
017792 - 00004	4/1/2003	GREAT BRITAIN	EN	TEMIK	098301	1 D-A, 1 H-C, 1 DW-A, 1 P-A & Summary of Pesticide Incidents, Great Britain HSE: 1/2003 - 3/2004. Field Operations Directive doc from WWW

Incident Package Report	Incident Date	Location	Country	Product Name	PC Code	Package Description
019363 - 00002	1/1/2008	AL	US	TEMIK 15 G	098301	Bayer: 1 H-C, itchy rash; 2 D-A, 1 W-B, misuse, 7 dogs, 3 opossums baited w/ Temik 15G; 6 G-A, aldicarb monitoring programs, 7.3-40.2 ppb.
019363 - 00003	1/1/2008	DOTHAN, AL	US	TEMIK 15 G	098301	Bayer: 1 H-C, itchy rash; 2 D-A, 1 W-B, misuse, 7 dogs, 3 opossums baited w/ Temik 15G; 6 G-A, aldicarb monitoring programs, 7.3-40.2 ppb.
021284 - 00001	1/1/1996	EUROPE (FR,SP,GR,BL,IT...	ZZ	ALDICARB	098301	Publ. article: domestic animal poisonings in Europe. Thousands of cases summarized briefly. Pesticides, plants, household chemicals...
021457 - 00003	2/13/2006	WA	US	ALDICARB	098301	Washington State PIRT report 2007 for 2006 data: only ecological incidents indexed, 2 D-A, 2 D-C, 3 P-A, 4 P-B, 11 P, 2 W-B.
021729 - 00010	4/1/2007	GOREBRIDGE, SCOTLAND	ST	ALICARB	098301	3 D-A, 33 W-B, A review of the illegal killing of birds of prey in Scotland in 2007, confirmed deliberate poisoning incidents during 2007.
022543 - 00001		NEAR CAMDEN, SC	US	TEMIK	098301	Several hunters sickened, 4 dogs died after rolling in Temik in woods, Lee County, SC. Hospital briefly locked down. See also I022570
022570 - 00001		SC	US	TEMIK	098301	WWW: 1 D-A, H-C: 4 hunting dogs killed and 13 hunters sent to hospital after contacting aldicarb found on property in Lee County, South Carolina. Updates I022543
023742 - 00003	3/1/2010	NEAR KINGSTREE, SC	US	TEMIK	098301	WWW: South Carolina: poisoning cases. In -001) man left pesticide laced hamburger patties in a shed where foxes had established a den. Killed 2 juvenile red foxes. Also nearby found 2 dead black vultures, 1 dead armadillo, 1 dead domestic cat, 1 dead domestic dog, 1 dead possum, and another carcass. Also 4 South Carolina cases with multiple dogs being poisoned-mainly Temik.
023742 - 00004	1/1/2009	SC	US	TEMIK	098301	WWW: South Carolina: poisoning cases. In -001) man left pesticide laced hamburger patties in a shed where foxes had established a den. Killed 2 juvenile red foxes. Also nearby found 2 dead black vultures, 1 dead armadillo, 1 dead domestic cat, 1 dead domestic dog, 1 dead possum, and another carcass. Also 4 South Carolina cases with multiple dogs being poisoned-mainly Temik.

Incident Package Report	Incident Date	Location	Country	Product Name	PC Code	Package Description
023742 - 00005	1/1/2010	BATESVILLE-LEESVILLE, SC	US	TEMIK	098301	WWW: South Carolina: poisoning cases. In -001) man left pesticide laced hamburger patties in a shed where foxes had established a den. Killed 2 juvenile red foxes. Also nearby found 2 dead black vultures, 1 dead armadillo, 1 dead domestic cat, 1 dead domestic dog, 1 dead possum, and another carcass. Also 4 South Carolina cases with multiple dogs being poisoned-mainly Temik.
024836 - 00029	5/1/2011		ST	ALDICARB	098301	Pesticide poisonings and screening in wildlife and a few domestic animals, Scotland, 2011. 94 cases listed in publication.
024836 - 00029	5/1/2011		ST	ALDICARB SULFOXIDE	110802	Pesticide poisonings and screening in wildlife and a few domestic animals, Scotland, 2011. 94 cases listed in publication.
026606 - 00001	5/1/2014	TANAT VALLEY, LLANGYNOG	WL	ALDICARB	098301	WWW: -001) dog out for a walk in forested Tanat Valley, Wales became sick suddenly and died. Lab analysis showed it died from aldicarb poisoning. Had ingested a black feathered bird which was suspected of having the poison in it. -002) nearby dead red kit was also found on footpath in that same area. Analysis showed aldicarb poisoning.
026958 - 00002	6/1/2010	SALT SPRINGS, FL	US	TEMIK	098301	WWW: -002)man who poisoned animals with Temik, Salt Springs, FL was given probation after apologizing: black bears, vultures hawk, raccoons, coyotes, bobcats, foxes, opossums found dead within 10 ft. of his property line. also 4 dogs poisoned. -003) summary of wildlife deaths due to US Dept. of Agriculture's trapping and poisoning. -004) death of dog due to M-44, -005) human employee had an antidote kit which may have saved his life after exposure to M-44.

Aggregate Incidents Associated with Aldicarb Products in the Incident Data System (IDS)

Incident Package And Sequence	Submission Date	Product Name	Ingredient Name	Package Description	Total Incident Count
016573 - 00073	8/31/2005	TEMIK (NON-SPECIFIC)	Temik	Bayer CropScience: 114 aggregate summaries, Apr. - June 2005. Incl. H-D D-A, D-B, D-C, D-D, 91 P-B, 16 G-B, 4 G-C	27

Incident Package And Sequence	Submission Date	Product Name	Ingredient Name	Package Description	Total Incident Count
021434 - 00094	11/24/2009	TEMIK BRAND 15G ALDICARB PESTICIDE	Aldicarb	Bayer CropScience: 107 Aggregate summaries Jul.-Sep. 2009. 420 H-D, 16 D-A, 6 D-B, 125 D-C, 168 D-D, 1 W-B (neurological-squirrel), 14 P-B, 9 G-B (Temik-NY), 3 ONT (bee deaths-DE, VA, FL). Backup details include date, caller, state, species, route, symptoms.	11
014025 - 00001	5/30/2003	TEMIK (NON-SPECIFIC)	Aldicarb (ANSI)	Bayer: 2 aggregate summaries, Jan.-Mar. 2003: incl. 4 W-B minor wildlife (Temik) and 2 P-B minor plant damage effects (Axiom 68DF).	4
014299 - 00030	8/27/2003	TEMIK 15G LOCK N LOAD	Aldicarb (ANSI)	Bayer: 31 aggregate summaries, Apr. - June 2003. Includes H-D, D-A, D-C, D-D, P-B, G-C	30
016573 - 00004	8/31/2005	TEMIK 15G	Aldicarb	Bayer CropScience: 114 aggregate summaries, Apr. - June 2005. Incl. H-D D-A, D-B, D-C, D-D, 91 P-B, 16 G-B, 4 G-C	1
008694 - 00003	5/28/1999	TEMIK BRAND 15G ALDICARB PESTICIDE	Aldicarb (ANSI)	Rhone-Poulenc: -001 Updates I008381 -001, product used was Albaugh: 10 Aggregate summary reports: 1/1 - 3/31/99: H-D, D-A, D-C/D/E, W-B, ONT, G-B/C	76
010562 - 00001	8/28/2000	TEMIK BRAND 15G GRANULAR ALDICARB PESTICIDE	Aldicarb (ANSI)	Aventis CropScience: 52 aggregate summaries, Apr. - June, 2000. Mostly P-B minor plant damage with H-D, domestic animals cases, 3 W-B	37
015078 - 00001	5/25/2004	TEMIK (NON-SPECIFIC)	Temik	Bayer CropScience; 3 aggregate summaries, Jan.- Mar, 2004. Incl, 2 H-D, 11 D-A, 4 D-B, 1 W-B (Temik), 4 G-B and 1 G-C	21
017666 - 00087	8/15/2006	TEMIK 15G LOCK 'N LOAD	Aldicarb	Bayer: 151 Aggregate Summaries, April - June 2006. 251 H-D, 17 D-A, 19 D-B, 88 D-C, 114 D-D, 1 W-B, 174 PD-B, 17 GW-B, 3 GW-C	1
017371 - 00034	5/30/2006	TEMIK (NON-SPECIFIC)	Aldicarb	Bayer CropScience: 62 Aggregate Summaries Jan.- March 2006. 51 H-D, 8 D-A, 3 D-B, 24 D-C, 29 D-D, 4 W-B, 4 P-B, 27 G-B, 233 G-C. Includes backup footnotes about water detects	22
021124 - 00088	9/1/2009	TEMIK BRAND 15G ALDICARB PESTICIDE	Aldicarb	Bayer: 111 aggregate summaries, Apr. - June 2009, Incl. 387 H-D, 23 D-A, 9 D-B, 143 D-C, 203 D-D, 1 W-B, 9 G-B, 45 P-B. Includes many backup details for caller, state, species, route, symptoms.	8
020805 - 00048	5/29/2009	TEMIK 15 G	Aldicarb	Bayer CropScience: 50 aggregate summaries, Jan. -Mar. 2009, Incl. 80 H-D, 18 D-A, 3 D-B, 34 D-C, 39 D-D, 2 P-B, 10 W-B, 3 G-B. Backup details include date, caller, species, route and symptoms.	10

Incident Package And Sequence	Submission Date	Product Name	Ingredient Name	Package Description	Total Incident Count
020557 - 00001	3/2/2009	TEMIK 15G	Aldicarb	Bayer CropScience: 49 aggregate summaries, Oct. -Dec. 2008, Incl. 73 H-D, 5 D-A, 1 D-B, 39 D-C, 43 D-D, 1 W-B, 1 P-B, 17 G-B. Backup details include date, caller, species, route and symptoms	18
022216 - 00066	8/31/2010	TEMIK BRAND 15G ALDICARB PESTICIDE	Aldicarb	Bayer: 127 aggregate summaries, Apr.-June 2010: human and domestic animal effects. Includes backup details for date, caller, state, species, route, symptoms.	4
018741 - 00051	8/8/2007	TEMIK BRAND (NON-SPECIFIC)	Aldicarb	Bayer: 119 aggregate summaries, Apr.-Jun. 2007. 270 H-D, 18 D-A, 13 D-B, 89 D-C, 118 D-D, 1 D-E, 1 W-B, 113 P-B, 16 G-B, 2 G-C.	10
022928 - 00005	5/26/2011	TEMIK 15 G	Aldicarb	Bayer CropScience: 55 aggregate summaries, Jan.-Mar. 2011. Includes 94 H-D, 6 D-A, 6 D-B, 32 D-C, 38 D-D, 1 W-B, 1 P-B, and 3 G-B. Backup details: caller, date, state, species, route, and symptoms are provided.	3